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Growth of the Small-Mouthed Black Bass, *Micropterus dolomieu* Lacépède, in Wisconsin Waters[1]

By George W. Bennett

Introduction

UP to the present time very little work has been done on the growth of the small-mouthed bass in natural waters. Reighard (1928) studied the growth of the species in Loon and Whitefish lakes in Gogebic County, Michigan, Hile (1931) in Indiana, and Tester (1932) in some of the waters of Ontario. Hubbs and Bailey (1938) have recently published an excellent account of the ecology and life history of the small-mouth, in which the question of growth is considered.

The material for the present study was obtained through the coöperation of the anglers of the state, the Wisconsin Conservation Department, the U. S. Bureau of Fisheries and the Wisconsin Geological and Natural History Survey. Anglers have contributed scales from 524 specimens, and 1013 specimens have been taken by the staff of the Trout Lake Limnological Laboratory over a period of about ten years. The laboratory collections were made in connection with food, parasite and population studies.

The scale collections contributed by anglers and part of those obtained by the laboratory staff have been used in reports on the growth of the small-mouth and of four other species of game fishes (Juday and Schneberger, 1930, 1931; Juday and Bennett, 1935; Juday and Schloemer, 1936, 1938). Much of the laboratory material was not included in these reports, which were issued in mimeographed form; but all of the usable material is included in the present study.

The calculations used in this paper were made on the basis of standard length in millimeters, assuming that the scale-body length ratio remains constant throughout life. Conversions from standard to total lengths and vice versa were made by using the ratio 1 : 1.18 (see Table 1). All total lengths are given in inches and standard lengths in millimeters.

Of the 1537 small-mouths represented in the collection, 86 (5.6%) had to be discarded because the scales were regenerate or otherwise unreadable, thus leaving 1451 specimens with readable scales; all of the unreadable scales belonged to the laboratory collection. In addition, 129 specimens belonged to the O and I age groups and they have been eliminated from the average growth calculations, so that the data really deal with only 1322 specimens of small-mouthed black bass.

Acknowledgments

The author is indebted to Mr. Ralph Lorch, assistant biologist of the Works Progress Administration, who assisted in this study during the winter of 1936–37. Professor Juday is responsible for the collection of the scales.

[1] From the Limnological Laboratory of the Wisconsin Geological and Natural History Survey. Notes and reports No. 86.

Distribution of Age Groups

Age groups O to XIV are represented in the scale collection under discussion. Tester (1932) lists two specimens taken from Perch Lake, Ontario, as 15 years old. One of the Wisconsin specimens was thought to have passed its fifteenth winter, but was finally discarded as questionable. The maximum age attained by the small-mouth black bass in Wisconsin, therefore, is 14 to 15 years, or approximately the same as that attained by the large-mouth (Bennett, 1937). Group V contained the largest number of specimens caught by anglers, as was true also of the large-mouthed bass. Groups III to X, inclusive, contained 95% of all small-mouths taken by anglers as compared with 89% for the large-mouth.

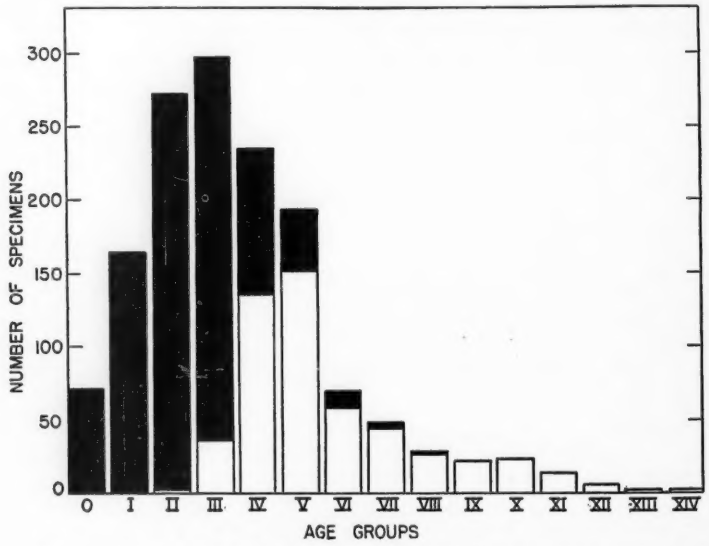

Fig. 1. Frequency distribution of 1451 small-mouthed black bass separated into the various age groups. The darkened areas represent specimens collected by the staff of the Trout Lake Laboratory; the clear areas represent collections of scales sent in by anglers.

The collections made by the laboratory staff consisted chiefly of small specimens, representing the younger age groups. Groups O to III include 83% of the catch and O to VI 98%.

The histogram of Figure 1 shows the distribution of the specimens by actual numbers. The black areas of the various columns represent the collections made by the laboratory staff and the white areas the specimens taken by anglers. This diagram shows that the majority of the specimens caught by anglers were in their fifth year of life, while the number in the fourth year ranked second. Very few specimens fall in the groups older than X.

Ratio of Standard to Total Length

Anglers' measurements were either of standard or total length in inches, while the laboratory measurements were of standard length in millimeters. In 188 specimens both standard and total lengths were taken and this material serves as the basis for the data given in Table 1. The lengths were

Table 1

Ratio of Standard to Total Length in 188 Specimens of Small-Mouthed Black Bass of Various Lengths

Standard length groups, mm.	No. of specimens	Average standard length, mm.	Average total length, mm.	Ratio standard to total length
90–120	13	110.6	130.5	1 : 1.18
121–150	31	131.8	155.2	1 : 1.18
151–180	42	166.8	196.5	1 : 1.18
181–210	21	190.7	225.5	1 : 1.18
211–240	20	222.3	262.9	1 : 1.18
241–270	19	251.8	300.1	1 : 1.19
271–300	24	284.8	336.4	1 : 1.18
301–330	9	312.7	368.6	1 : 1.18
331–360	3	356.0	426.7	1 : 1.20
361–390	3	377.7	445.7	1 : 1.18
391–420	3	403.7	471.7	1 : 1.17

arranged in classes of 30 mm. limits and the average standard and total lengths were computed for each group. The ratios of the groups vary from 1 : 1.17 to 1 : 1.20; but 8 of the 11 groups gave a ratio of 1 : 1.18, and this ratio has been used in all of the computations. It will be noted that this ratio holds for the range of lengths from 90 mm. to 420 mm. (4.2 to 19.5 inches in total length) which covers the length range of the great majority of the specimens represented in the scale collection.

Rate of Growth

The rate of growth of the small-mouthed bass varies not only between regions having unequal lengths of growing season, but also between bodies of water located in the same general region. In Ontario lakes Tester (1932) states that legal length (10 inches) is attained during the fifth summer in Perch and Phantom lakes, during the fourth summer in Nipissing, and during the sixth summer in Georgian Bay, Lake Huron. Hile (1931) lists a small-mouth from Lake Wawasee, Indiana, which probably had reached a length of 10 inches during the fourth summer. Reighard (1928) obtained several specimens from two lakes in Gogebic County, Michigan, which had an average age of 10.5 years and an average length of 14.5 inches, thus showing slow rate of growth. Discussing the growth of the small-mouth in the Delaware River (New York), Bishop (1936) states that no specimens had attained legal length at two plus years and one was below this length at five plus years. The two sexes were about equally represented among his specimens.

Small-mouth scale collections have been obtained from 102 lakes and three rivers in Wisconsin. The maximum number of specimens from a single lake was 226 from Ike Walton Lake in Vilas County; and several fairly

large collections were made from other lakes in this same region. Ten specimens or more were taken in 19 lakes and one stream, while several other bodies of water have contributed 5 to 9 specimens.

TABLE 2

CALCULATED LENGTHS BY YEARS OF SMALL-MOUTHED BLACK BASS IN 19 LAKES AND ONE STREAM IN NORTHERN WISCONSIN

Lake	No. Specimens		Calculated standard and total lengths by years 1	2	3	4	5	6	7	8	9	10	11
Black Oak	11	St.L. Cm.[1]	4.6	10.2	17.1	22.9	28.1	31.9	34.9	38.3			
		T. L. In.	2.2	4.7	7.9	10.7	13.1	14.8	16.2	17.8			
Clear	10	St.L. Cm.	4.2	10.0	14.5	23.0							
		T. L. In.	1.9	4.7	6.7	10.7							
Crystal	47	St.L. Cm.	4.9	9.9	16.3	24.8	31.4	36.2	40.5				
		T. L. In.	2.3	4.6	7.6	11.5	14.6	16.8	18.8				
Durphee	11	St.L. Cm.	4.7	13.5	23.4	29.9	34.6	38.3	40.8	43.0			
		T. L. In.	2.2	6.3	10.9	13.9	16.1	17.8	18.9	20.0			
High	11	St.L. Cm.	5.1	12.1	19.6	24.1	29.4	35.0	37.0	39.9	47.3		
		T. L. In.	2.4	5.6	9.1	11.2	13.7	15.3	17.2	18.5	22.0		
Ike Walton	226	St.L. Cm.	5.1	10.5	16.3	20.9	25.0	27.3	30.0	33.9	36.1	37.8	39.5
		T. L. In.	2.4	4.9	7.6	9.7	11.6	12.7	13.9	15.8	16.8	17.6	18.4
Jute	27	St.L. Cm.	5.1	9.9	14.4	17.8							
		T. L. In.	2.4	4.6	6.7	8.3							
Larry	48	St.L. Cm.	3.6	9.6	14.5								
		T. L. In.	1.7	4.5	6.7								
Muskellunge	212	St.L. Cm.	4.9	11.7	17.1	21.1	23.9	25.7					
		T. L. In.	2.3	5.4	8.0	9.8	11.1	11.9					
Nebish	183	St.L. Cm.	5.2	11.6	17.4	21.3	22.9	21.5	26.3				
		T. L. In.	2.4	5.4	8.1	9.9	10.6	10.0	12.2				
Owen	11	St.L. Cm.	4.0	9.2	14.5	19.3	22.5	25.5	26.8	30.0	34.3		
		T. L. In.	1.9	4.3	6.7	9.0	10.5	11.8	12.4	13.9	15.9		
Pallette	83	St.L. Cm.	5.6	13.0	17.3	20.3	24.0	27.1					
		T. L. In.	2.6	6.1	8.0	9.4	11.1	12.6					
Razorback	18	St.L. Cm.	4.5	9.8	14.3	18.8							
		T. L. In.	2.1	4.6	6.6	8.7							
Rock	13	St.L. Cm.	6.8	14.3	19.2	26.1	30.8	33.1					
		T. L. In.	3.2	6.6	8.9	12.1	14.3	15.4					
Sand	41	St.L. Cm.	4.5	11.4	19.2	24.8	28.1	31.2	33.2	34.3	37.5	39.5	40.1
		T. L. In.	2.1	5.3	8.9	11.5	13.1	14.5	15.4	15.9	17.4	18.3	18.6
Silver	67	St.L. Cm.	5.0	11.6	17.0	20.5	24.9	29.2	33.6	36.8			
		T. L. In.	2.3	5.4	7.9	9.5	11.6	13.5	15.6	17.1			
Trout	27	St.L. Cm.	4.6	12.9	19.7	27.6	31.0	33.2	34.9	36.2	37.4	38.6	39.2
		T. L. In.	2.1	6.0	9.1	12.8	14.4	15.5	16.2	16.8	17.4	17.9	18.2
Weber	41	St.L. Cm.	6.8	14.8	21.9	29.4	35.9	41.0					
		T. L. In.	3.2	6.9	10.2	13.6	16.7	19.1					
Wildcat	25	St.L. Cm.	4.9	10.5	17.3	22.0	25.2	31.0					
		T. L. In.	2.3	4.9	8.0	10.2	11.7	14.4					
Yellow River	10	St.L. Cm.	4.9	11.8	17.5	22.6	25.7	25.3	28.7	31.8			
		T. L. In.	2.3	5.5	8.1	10.5	11.9	11.8	13.3	14.8			
Av. Length,	1122	St.L. Cm.	5.0	11.4	17.4	23.0	27.7	30.7	33.3	36.0	38.5	38.6	39.6
N. Lakes		T. L. In.	2.3	5.3	8.1	10.7	12.9	14.3	15.5	16.7	17.9	18.0	18.4
Increments,	1122	Cm.	5.0	6.4	6.0	5.6	4.7	3.0	2.6	2.7	2.5	0.1	1.0
N. Lakes		In.	2.3	3.0	2.8	2.6	2.2	1.4	1.2	1.2	1.2	0.1	0.4
Gen. Aver.,	1322	St.L. Cm.	5.1	11.5	17.6	22.9	26.9	30.3	33.0	35.8	37.8	39.4	40.7
All Lakes		T. L. In.	2.4	5.3	8.2	10.6	12.5	14.1	15.3	16.7	17.6	18.3	18.9
Increments,	1322	Cm.	5.1	6.4	6.1	5.3	3.0	3.4	2.7	2.8	2.0	1.6	1.3
All Lakes		In.	2.4	2.9	2.9	2.6	1.7	1.6	1.2	1.4	0.9	0.7	0.6

[1] St. L. represents standard length; T. L. represents total length.

Table 2 shows the rate of growth of the small-mouth bass in the 19 lakes and one river in northern Wisconsin from which 10 or more specimens were obtained. It also shows the average rate of growth in these 20 bodies of water combined, as well as the general average for all lakes and streams represented in the collection. This general average, and the average annual increments are shown graphically in Fig. 2. The growth curve shows that the average small-mouth reaches a legal length of 10 inches during the fourth year of life and that an average of a little more than 15 inches is attained during the seventh year.

The increment curve in the lower part of Fig. 2 shows that increase in length during the first four years averages a little more than 2.5 inches per

year, but it declines to 0.6 inch in the eleventh; the specimens are too few in later years to give a representative average.

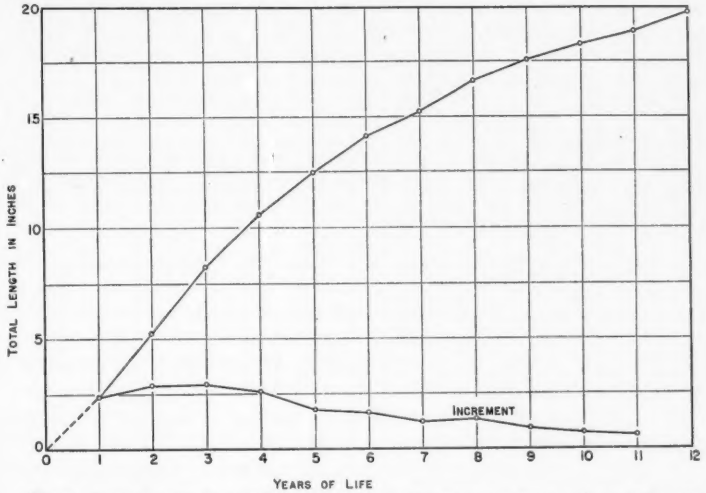

Fig. 2. Average growth and increment curves for 1322 specimens of small-mouthed bass.

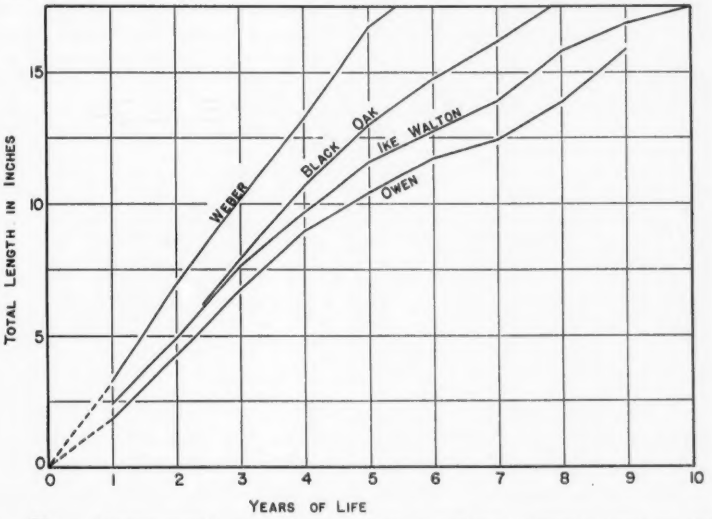

Fig. 3. Average growth curves for four lakes in northern Wisconsin, based on data given in Table 2.

The specimen which showed the most rapid growth was taken in Pike Lake, Price County. It was in its sixth or seventh year of life and weighed

6 pounds, thus showing an average weight increase of approximately one pound per year. The usual rate of gain for specimens of this size is about half a pound per year. This fish was taken from the same drainage area as the most rapidly growing large-mouth (Bennett, 1937). The largest specimen represented in the scale collection weighed 6 pounds 10 ounces, and was in its twelfth summer when caught. Another specimen weighing 7 pounds 8 ounces was taken in Des Moines Lake in Burnett County in 1937, but no scales were obtained from it.

Differences in the rate of growth among four lakes are shown in Fig. 3. These curves are based on the results given in Table 2, which also shows the differences in the rate of growth among 20 bodies of water. The fish from Durphee Lake showed the maximum rate of growth, though those of Weber Lake had grown approximately as fast. Fish from Lake Owen indicated the poorest growth of any lake from which 10 or more specimens were obtained. Their rate was substantially the same as that of specimens from Jute, Larry and Razorback lakes whose small-mouths are characterized by a very slow growth. The fish from Black Oak and Ike Walton lakes fell between the two extremes of growth.

It is true that 10 or 20 specimens are too few to indicate more than a general trend of the growth in a lake. One should have 100 to 200 specimens to obtain something approaching an adequate idea of the rate of growth.

TABLE 3

APPROXIMATE TIME WHEN SMALL-MOUTHED BLACK BASS REACH A TOTAL LENGTH OF 10 INCHES IN 16 LAKES AND ONE RIVER IN NORTHERN WISCONSIN

Lake	Ten inches attained in
Durphee	Middle of 3rd summer
Weber	End of 3rd summer
Crystal	Early in 4th summer
High	Early in 4th summer
Rock	Early in 4th summer
Trout	Early in 4th summer
Black Oak	Middle of 4th summer
Clear	Middle of 4th summer
Wildcat	Middle of 4th summer
Yellow River	Middle of 4th summer
Ike Walton	Early in 5th summer
Muskellunge	Early in 5th summer
Nebish	Early in 5th summer
Pallette	Early in 5th summer
Sand	Early in 5th summer
Silver	Early in 5th summer
Owen	Middle of 5th summer

Table 3 gives the approximate ages when the small-mouths of 16 northern lakes and one stream reached a legal length of 10 inches. It is based on the data given in Table 2. Legal sizes were not obtained from three of the northern lakes, which are consequently omitted. The averages indicate that the fish in Durphee and Weber lakes reach a length of 10 inches during the third year of life; in 8 other lakes and one stream, they attain this length during the fourth year of life and in 6 lakes during the fifth year.

Table 2 also shows that the small-mouths of Durphee and Weber lakes reach a length of 15 inches during the fifth year; Crystal, High, Rock and

Trout during the sixth; Black Oak, Sand and Silver during the seventh; Ike Walton during the eighth and Owen during the ninth. The largest specimens from the other lakes were less than 15 inches long.

A catch of 110 fish was made in Weber Lake on August 3, 1937. All of these specimens were in their second summer of life and showed a rather wide range in rate of growth. Their lengths ranged from 98 to 196 mm. standard length, averaging 137 mm. (4.6 to 9.1 inches total length, averaging 6.4 inches). It seems probable that some of the largest of these specimens had reached a length of 10 inches before the close of the second growing season. This augmented growth rate was probably due to a marked increase in the crop of plankton produced by the addition of soybean meal as a fertilizer in 1936. The standing crop of plankton was also larger than usual in 1937.

Differential Growth Rate of Sexes

There is much evidence that in the centrarchids, the males grow somewhat larger and faster than the females. This has been found by Creaser (1926) for *Eupomotis gibbosus;* Hubbs and Hubbs (1932) for *Eupomotis gibbosus* and *Helioperca macrochira;* and Hubbs and Cooper (1935) for *Apomotis cyanellus, Ambloplites rupestris* and *Xenotis megalotis.* Tester (1932) says of *Micropterus dolomieu*: "On the average, female bass from Perch Lake grew at a slightly slower rate than male bass. In older year groups this difference was not detected, possibly because of the small number of specimens and the more extensive individual variation in older fish. Whether the differential growth rate observed for Perch Lake specimens is general or not can be detected only by considering a large number of specimens of both sexes in other bodies of water."

Survey collections of small-mouth from lakes in Vilas County furnish some sex data from Muskellunge, Nebish, Pallette and Larry lakes. The calculated standard lengths in millimeters of males and females are shown in Table 4.

Table 4

Average Calculated Lengths of Male and Female Bass by Years of Life, from Muskellunge, Nebish, Pallette and Larry Lakes

Lake	No. Spec.	Year of Life 1	2	3	4	5	6
Muskellunge							
Males	37	50.2	126.0	186.6	229.5		
Females	38	52.1	125.9	184.8	241.3		
Nebish							
Males	36	53.1	119.9	178.9	212.6	270.0	
Females	35	49.3	113.6	176.6	225.6	239.0	
Pallette							
Males	19	53.0	132.4	176.5	229.2	249.0	
Females	23	66.4	135.5	173.0	195.8	235.0	280.5
Larry							
Males	26	35.2	87.8	142.3			
Females	20	37.9	101.3	148.9			

Table 4 shows that for the small numbers of individuals used, the variation is such that any possible growth differentiation between sexes is ob-

scured. In the Muskellunge Lake sample, the length advantage is apparently first in favor of the females, shifts to the males during the second and third years, and back to the females in the fourth year. In Nebish Lake the males appear larger except in calculations for the fourth year. In Pallette Lake the females show an advantage for the first two years, which they subsequently lose. In Larry Lake the females appear consistently larger. Actual average lengths of the sexes from the above lakes show the same variations as do the calculated lengths. If male small-mouths do grow more rapidly than females, the advantage must be too small to be demonstrated in any but very large samples.

Coefficient of Condition

Hile (1936) gives a discussion of the relationship of weight to length in fishes, and a critique of previous authors who have used this relationship for the calculation of unknown weights from lengths, relative heaviness, and "condition" as determined by the use of empirical exponents.

Hile uses the formula (f) $K = \frac{W}{L^3} .10^5$ to determine the coefficient of condition, where W represents weight in grams, and L length in millimeters.

Table 5

Values of K and Lengths of Bass from Muskellunge Lake

Lengths (St. L. mm.)	No.	K	Age Group Represented
100–109	(4)	2.17	I, 3; II, 1
110–119	(11)	2.04	I, 2; II, 8; ?, 1
120–129	(24)	2.07	O, 4; I, 2; II, 18
130–139	(17)	2.24	II, 16; ?, 1
140–149	(10)	2.23	II, 10
150–159	(3)	2.00	II, 3
160–169	(18)	2.16	II, 7; III, 11
170–179	(19)	2.18	II, 2; III, 17
180–189	(18)	2.25	III, 16; IV, 1; ?, 1
190–199	(17)	2.24	II, 2; III, 14; ?, 1
200–209	(4)	2.25	III, 4
210–219	(4)	2.25	III, 4
220–229	(6)	2.38	III, 1; IV, 5
230–239	(6)	2.30	III, 2; IV, 4
240–249	(5)	2.40	III, 2; IV, 3
250–259	(5)	2.56	IV, 5

The value of K changes with any change in relative heaviness of stature. Therefore, it is possible by determining the value of K for successively longer fish from any lake, to say whether the relative heaviness remains constant or becomes greater with greater length. Also K values and hence condition of the fish may be compared from lake to lake, provided the length of fish and season are comparable.

Those familiar with the small-mouth will assume an increase in relative heaviness with increase in length. This is, of course, most pronounced just before spawning when the sexual products distend the abdomen, but the condition is obvious at other times.

To determine if there actually is a change in relative heaviness, bass from Muskellunge Lake were grouped according to 10 millimeter size classes, and the value of K calculated for each class (Table 5). The collections used

were all taken after the spawning period (July and August) and represent several years, among which the values of K undoubtedly vary. Unfortunately, the collections could not be separated by years because of the small numbers of specimens.

Table 5 shows an irregular increase in the value of K with increase in length. The classes ranging from 220 to 260 mm. show K values that do not appear in any of the shorter groups. Likewise, the K values of 2.04 for length group 110–119 and 2.07 for 120 to 129, with one exception (150–159 mm.), are smaller than values for greater lengths. The irregularities in the table may be due to small numbers of specimens and variations in K values from Muskellunge Lake for different years.

Since length is a function of the age, K must also be a function of age. This is shown in Table 6, where the average K value for all years taken together is given in the second column, and those for each year of collection at the right.

TABLE 6

THE VALUE OF K BY AGE GROUPS OF SMALL-MOUTHED BLACK BASS FROM MUSKELLUNGE LAKE

Group	average K for all years	Average Value of K for Collections of			
		1928	1930	1931	1932
O	(5) 2.22		(4) 2.19	(1) 2.31	
I	(7) 1.96				(7) 1.96
II	(68)[2] 2.18	(1) 2.34	(5) 2.33	(24) 2.13	(17) 2.06
III	(73)[3] 2.20	(3) 2.48	(2) 2.22	(20) 2.25	(47) 2.16
IV	(18) 2.45			(9) 2.50	(6) 2.35

The collection for 1932 presents the greatest number of specimens and here the value of K increases in a regular manner. In the year 1931, with the exception of one specimen belonging to the O Group, the increasing value of K is regular. From the above one can state that the relative heaviness of small-mouth increases as the fish become larger and older.

TABLE 7

VALUES OF K AND AVERAGE STANDARD LENGTH FOR AGE GROUP III COLLECTED FROM LARRY, MUSKELLUNGE, NEBISH, PALLETTE, SILVER, AND WEBER LAKES DURING JULY AND AUGUST, 1931

Lake	No.	Av. St. L. mm.	K
Larry	32	172.2	2.08
Muskellunge	20	192.6	2.25
Nebish	20	185.2	1.90
Pallette	7	202.3	2.09
Silver	10	208.8	2.08
Weber	1	232.0	2.24

To compare the values of K for small-mouth from several lakes it was necessary to compare the maximum collections of one age group collected during part of a single year. This special requirement greatly restricts the numbers of specimens available. Age Group III, 1931, from Larry, Muskellunge, Nebish, Pallette, Silver and Weber lakes was selected as being

[2] Two specimens collcted in 1936 and 19 in 1937 are not included.
[3] One specimen collected in 1933 is not included.

represented by the greatest number of specimens, and those collected during July and August, 1931, were used in the construction of Table 7.

Schneberger (1934) gives the values of K for the yellow perch, from Nebish, Weber, and Silver lakes, Group III, 1931, as 1.82, 1.67, and 1.55 respectively. He states: "It will be seen that the perch from Nebish are in the best condition, while those from Silver are in the poorest condition. Weber Lake forms an intermediate group. The same situation is found in the rate of growth, as will be seen later." The small amount of data available for the small-mouth do not show a direct relation between rate of growth and K, since the longest fish in Group III (taken from Silver Lake) had a K value of 2.08, and the shortest fish (from Larry Lake) also had a K value of 2.08. The smallest and largest K values are from Nebish (1.90) and Muskellunge (2.25) respectively, while the difference in average length is only 7 mm. in favor of Muskellunge. Perhaps the differences in K values between the sexes, even after the spawning period is over, are great enough to make it impractical to disregard them.

From this brief consideration of coefficient of condition it seems that the relative heaviness of the small-mouth varies directly with the length, but that the relationship differs for different lakes. Larry Lake, known to have a population of stunted bass, shows a surprisingly high K value (2.08) as does Muskellunge, where the rate of growth in length is slow. Both Pallette and Silver lakes show a better growth rate than Muskellunge, although their K values are less. These data suggest problems to be considered in the future when more specimens are available.

A Comparison of Growth Rates of the Large- and Small-Mouthed Black Basses in Wisconsin

Both the large- and small-mouthed black basses are abundant in the lakes of Wisconsin. In general, the latter is more numerous in the north, while the former is more common in the south. Both are present in a large number of lakes.

TABLE 8

A Comparison of the Average Growth Rates of the Large and Small-Mouthed Black Basses in Wisconsin. Calculated Total Lengths in Inches at the End of Each Year of Life

Species	No. Spec.	Year of Life 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Small-Mouthed Bass	1322	2.4	5.7	8.8	11.4	13.4	14.8	15.9	16.9	17.9	18.2	18.7	19.7	19.3	18.5
Large-Mouthed Bass	618	3.3	7.4	10.5	12.5	14.0	15.1	16.3	17.4	18.1	18.7	19.5	19.9	20.2	20.6

Since both species are highly valued as game fish, it is important to know which shows the greater growth rate under diverse environmental conditions. At present the Wisconsin Conservation Department plants many more large-mouth than small-mouth; in the last stocking report this ratio was about 96 to 1 in favor of the former. In southern Wisconsin the small-mouth returns from fishermen are scanty and most of the bass records are for the large-mouth. However, in northern Wisconsin, although the large-mouth records are less abundant, substantial numbers are taken from some of the lakes. Using the growth records for about 600 specimens of large-mouth (Bennett, 1937)

a comparison was made between the growth of the two species for the state as a whole.

The calculated growth rates for both species are given in Table 8. From the table it may be seen that the average large-mouth reaches 10 inches during the third summer, while the small-mouth does not reach that length until the fourth summer. Furthermore, the length of the large-mouth is always somewhat greater (as is also the weight, because the large-mouth is of stockier build) than that of the small-mouth at the end of any year of life.

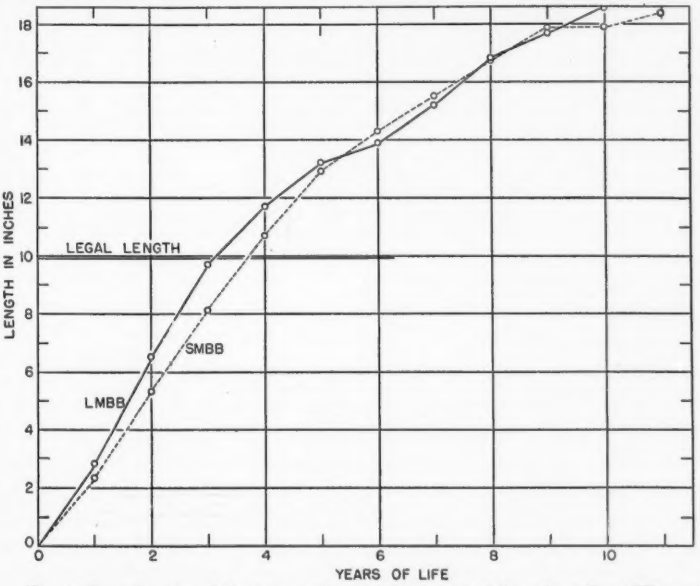

Fig. 4. Growth rates of the two species of black bass in lakes of northern Wisconsin. The curve for the small-mouthed bass (SMBB) falls below that of the large-mouthed bass (LMBB) in the early years of life but equals it in the later years.

However, a more favorable growth rate, resulting from a longer growing season, has been shown for the large-mouth in southern Wisconsin (Bennett, 1937). It seems probable that the small-mouth is affected in the same way. As 90% of the small-mouths are northern fish (as compared with 65% of the large-mouths) comparison can better be made by using only specimens from the northern part of the state. Scale collections include large-mouth from 12 northern lakes and of small-mouth from 20 northern lakes. Growth rates were determined for individual lakes and the lake averages considered as units in a general average. Table 9 and fig. 4 show the average growth rates of the two species in northern Wisconsin. These averages show that the large-mouth in the north attains legal length early in the fourth summer, while the small-mouth reaches that length later during the fourth summer. By the end of that summer the large-mouth is nearly 12 inches long, while the small-mouth is an inch shorter.

TABLE 9

CALCULATED LENGTHS IN INCHES AT THE END OF EACH STATED YEAR OF LIFE FOR LARGE-MOUTHED AND SMALL-MOUTHED BLACK BASSES IN NORTHERN WISCONSIN

Species	No. Lakes Averaged	Year of Life 1	2	3	4	5	6	7	8	9	10	11	12	13
Small-Mouthed Bass	20	2.3	5.3	8.1	10.7	12.9	14.3	15.1	16.8	17.9	17.9	18.4	19.2	18.7
Large-Mouthed Bass	12	2.8	6.5	9.7	11.7	13.2	13.9	15.2	16.7	17.7	18.5	19.3	19.1	19.3

From four lakes in Vilas County, examples of both species were collected. The numbers of specimens are small in some cases, so that the resulting averages should not be taken as more than growth trends in these lakes. Table 10 contains the calculated growth rates of both species, and the number of specimens in each sample, collected from Ike Walton, Larry, Black Oak, and Muskellunge lakes.

TABLE 10

CALCULATED TOTAL LENGTHS IN INCHES AT THE END OF EACH YEAR OF LIFE FOR LARGE- AND SMALL-MOUTHED BLACK BASSES FROM FOUR VILAS COUNTY LAKES

Species	No. Spec.	Year of Life 1	2	3	4	5	6	7	8	9	10	11	12
Ike Walton Lake—													
Small-Mouthed Bass	226	2.4	4.9	7.6	9.7	11.6	12.3	13.9	15.8	16.9	17.5		
Large-Mouthed Bass	21	3.1	6.6	9.5	11.1	12.2	12.6	13.5					
Larry Lake—													
Small-Mouthed Bass	48	1.7	4.5	6.8									
Large-Mouthed Bass	17	1.7	4.5	6.8	8.7	9.3							
Black Oak Lake—													
Small-Mouthed Bass	11	2.2	5.2	7.9	10.7	13.1	14.8	16.2	17.8				
Large-Mouthed Bass	12	3.1	6.0	8.9	10.8	12.7	14.8	15.3	15.9	16.7	16.2	17.1	17.6
Muskellunge Lake—													
Small-Mouthed Bass	212	2.3	5.4	7.9	9.8	11.1	11.9						
Large-Mouthed Bass	39	2.8	5.6	8.4	10.1	11.7	12.5	13.9	14.8	16.1	17.5		

Both species from Ike Walton Lake were collected by anglers. In this lake, during early years, the large-mouth shows a distinct advantage over the small-mouth in growth rate, reaching legal length one full year earlier.

In Larry Lake the growth rates of the two species coincide, and apparently neither would reach legal length through five summers of growth, although no small-mouth were taken at an age older than three years. Larry Lake apparently is over-stocked, so that there is much competition for food. One may conclude, with reservation, that in Larry, where both are under conditions of extreme competition, neither species shows a faster growth rate than the other.

The averages for Black Oak Lake represent small numbers of specimens, but here the large-mouth shows a slight growth advantage.

Among a larger number of specimens from Muskellunge Lake, the large-mouth also shows a slight growth advantage, reaching legal length at the end of the fourth summer. The small-mouth falls short by a fraction of an inch. Muskellunge Lake is known to have a large fish population of several species, each showing comparatively stunted growth rates. Here the small-mouth is somewhat more numerous than the large-mouth.

In every lake, with the exception of Larry, the large-mouth shows a length advantage in growth rate. Where this advantage amounts to attaining legal length a full summer earlier, the survivors of a year's spawn of large-mouth

may be available to anglers a year earlier than the corresponding hatch of small-mouth, and thus produce a more rapid turnover in fishing.

Summary

1. This study is based on scale collections from 1537 small-mouthed black bass taken in Wisconsin waters, chiefly from the northern half of the state.

2. The oldest specimen was in the XIV age group. The largest number of specimens caught by anglers were in group V, and 95% of them belonged to groups III to X, inclusive.

3. The ratio of standard to total length in the small-mouth is 1:1.18.

4. The average growth is such that the small-mouth attains a length of 10 inches (legal length) during the fourth year. Annual increments in length decrease after this age and fall below one inch per year after the eighth year. The fastest growing specimen weighed 6 pounds and was in its sixth or seventh year of life, so that its average annual gain was approximately one pound per year. The largest specimen weighed 6 pounds 10 ounces and was in its twelfth year of life, thus showing an average gain of a little more than half a pound per year, which is about the usual rate of gain for small-mouths weighing 4 pounds or more.

5. Average growth rates of specimens from 19 lakes and one river showed considerable variation.

6. No consistent differences in growth rates between male and female fish were found in Muskellunge, Nebish, Pallette and Larry lakes.

7. The coefficient of condition increases with length and age in the small-mouths of Muskellunge Lake. A large K value does not seem to be correlated with rapid growth in all cases.

8. The small-mouthed bass grows somewhat more slowly than the large-mouthed bass. In some lakes the large-mouth reaches legal length (10 inches) one year earlier than the small-mouth.

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ILLINOIS NATURAL HISTORY SURVEY, URBANA, ILLINOIS.

Four Whale Sharks Rammed by Steamers in the Red Sea Region

By E. W. GUDGER

IN April, 1937, Prof. W. H. Hoffman of Havana sent me a clipping from the *Hamburger Nachrichten* of March 8, 1936, concerning a large shark, presumably a whale shark, struck by the liner "President Wilson" near Socotra Island, where the Gulf of Aden joins the northwestern Indian Ocean. Then began a search for an officer of this ship who had seen the fish on the stem of the vessel and who could describe it so that I might know whether it was a whale shark or no. At length I was so fortunate as to get in touch at Alameda, California, with the chief officer of the "President Wilson," Mr. V. Nielsen, who gave me specific accounts not of one whale shark rammed

by his vessel in the Red Sea region, but of *two*.

Mr. Nielsen was on the bow of the vessel in charge of operations of getting clear of both sharks. He saw everything and is a first hand witness to both incidents. To his accounts, which leave no possible doubt as to the identity of the sharks, two published records of like incidents in this region will be added. Apparently more whale sharks have been rammed by steamers in the Red Sea region than in any other part of the world.

THE "PRESIDENT WILSON" *Rhineodon* No. 1.—On January 28, 1936, the "President Wilson" was steaming along at about 15 knots per hour on a passage from Bombay to Suez, when about 2 P.M. she struck a great shark. The vessel was then in Lat. 14° 50′ N. and Long. 54° 44′ E. or just north of Socotra Island, where the Gulf of Aden joins the northwestern Indian Ocean. On inspection it was found that the prow had cut a great gash about a foot deep on the left side of the fish. The shark was caught about 8 feet back of the head, and about one-third of the fish hung on the left side of the stem. This *Rhineodon* was a big fellow, estimated at about 45 feet long. It was held on the stem by the forward motion of the vessel, and to free the bow of the encumbrance, the ship had to be stopped and backed for 6 minutes. Mr. Nielsen was on the bow at the time and saw the fish as it was stretched out when it floated free. The shark was not killed by the impact, but threshed about with the great tail while held on the bow. When freed by the backing of the vessel, the fish straightened out, dove and swam away leaving a trail of blood.

Not only does Mr. Nielsen clearly describe the fish but he has sent me photographs of the shark as it hung on the stem about two feet below water level. The water disturbed by the forward motion of vessel and fish obscured the views of the fish, but the spots are plainly shown, and clearly identify it as a whale shark.

THE "PRESIDENT WILSON" *Rhineodon* No. 2.—On April 1, 1937, the "President Wilson" was in the Red Sea, northeast of the port of Massaua and more exactly in about Lat. 15° 31′ N. and Long. 41° 15′ E., on a passage from Colombo to Suez. The ship was making about 17 knots, when it was found about 10:30 A.M. that another whale shark was caught on the stem. No one knew when the fish was struck, but as the shark was cut almost into two parts about 8 feet back of the head, it is thought that it must have been pushed ahead of the ship for some time. The fish was about 3 feet under the water and the splashing waves made for poor visibility; but the spots showed clearly, leaving no possible doubt that the shark was a *Rhineodon*.

This fish, estimated at about 30 feet long, was smaller than the other, and hence an effort was made to dislodge it by pulling the rudder first to the left and then to the right. But all efforts were vain and the ship had to be stopped and backed for about 8 minutes. When clear of the ship, the dead fish, now plainly seen, slowly sank out of sight.

However these are not the first whale sharks rammed by vessels in the Red Sea region. Two others have had this bad fortune happen to them, and strange to say both in the same year—1933.

THE "FRANCESCO CRISPI" FISH.—In 1934 Dr. Hoffman sent me a clipping from an unnamed German newspaper, showing a whale shark (12 m. long) hanging on a cable off the right bow of the S. S. "Francesco Crispi." This had been rammed by the vessel and its back had been broken. Nothing could be learned from Germany about the great fish, but various hints led to the sending of letters of inquiry over the next two years to persons located in places as widely separated as Papeete, Tahiti, and Eritrea, Italian Somaliland—and all in vain. However, it was presently learned that the whole incident had been thoroughly studied and the fish described by an Italian scientist, Dr. Renato Santucci (1934).[1]

On May 14, 1933, the "Francesco Crispi" shortly after leaving Port Sudan (situated at about the middle point of the west coast of the Red Sea) had her speed diminished slightly. The officer on the bridge had noted a slight noise and shock as if the ship had run into some floating body. Since it was night, nothing could be seen. In the morning, however, an enormous shark was found bent almost double across the stem of the "Crispi." A steel cable was got around the fish and it was hoisted aboard the vessel, which proceeded on its way to the port of Massaua.

The specimen was taken over by the Director of the Italian Fisheries of East Africa to be cut up for utilization of its skin and flesh. This gave Santucci, who fortunately was in Massaua, a chance to study the fish morphologically. His paper is illustrated by a number of photographs, the originals of two of which he has kindly sent me.

THE "JOHAN VAN OLDEBARNEVELT" SHARK.—In November of the same year (1933), the Dutch mail steamer "Johan van Oldebarnevelt" rammed a whale shark off the Island of Perim in the Strait of Bab el Mandeb, so that the head was on the left side of the prow and the threshing tail on the right. To dislodge the fish the steamer had to be stopped. The fish then got free and, showing on the left side a big wound (which was probably fatal), it slowly sank into the depths. Its length was estimated at from 20 to 25 feet.

Fortunately, the Dutch zoologist, H. C. Delsman, was on board the ship. He definitely identified the shark as *Rhineodon typus*, and recorded the interesting incident in *Nature*.[2]

It is interesting that four whale sharks should have been rammed by steamers in the Red Sea region—two in the Sea itself (on its western coast), one in the Strait of Bab el Mandeb, and the fourth where the Gulf of Aden joins up with the northwestern Indian Ocean. Whale sharks must surely abound in this region.

The "President Wilson" is not the only steamer to have rammed *two* whale sharks. As I have elsewhere recorded,[3] the "Oldebarnevelt" in November, 1932, caught another whale shark on her stem about 150 miles west of Colombo, Ceylon.

Other like accidents to this greatest of the sharks have been reported from various parts of the world and are plainly indicative of its habits and

[1] *Boll. Mus. Lab. Zool. Anat. Comp. Univ. Genova*, 1934, 14: 3–14, 8 figs.
[2] 1934, 133: 176.
[3] *Nature*, 1937, 139: 549.

behavior. The fish has no enemies. It is harmless, sluggish and unafraid. It has been observed swimming so closely to vessels as to leave the impression that it was inspecting them. It gets speared on the bow of a steamer, either because it lies inert in the path of the approaching ship, or because it swims across that path so sluggishly that it is caught. I have one record of a *Rhineodon* which swam so leisurely across the bow of a vessel, that it was missed by only a few feet.

Surely the ramming method of capturing whale sharks is an unusual one. Other vessels have records, but the "Johan van Oldebarnevelt" and the "President Wilson" are the only ones to have thus taken two each.

American Museum of Natural History, New York City.

A Synopsis of the North American Water Snakes of the Genus *Natrix*

By William M. Clay[1]

In a forthcoming study of some of the North American species of water snakes of the genus *Natrix*, the writer will offer evidence for altering the systematic status of several forms. As the publication of this study is still deferred, it appears desirable to present the proposed nomenclature in a short paper, with a key. In order that the key may be as useful as possible, all the American species of the genus have been included. The taxonomic status of the species other than *sipedon, rhombifera,* and *erythrogaster* is that in current use.

Some of the forms of *Natrix* are so variable that one should not trust a key too implicitly. For this reason a diagnosis of each form is provided which may be of help with specimens whose identity is still in doubt after using the key. With the diagnosis I have included a brief synonymy, citing the original description, with the type locality, and the authority who first used the name here employed, together with a brief statement of the geographic range. The serial arrangement of the various species and subspecies groups them to some extent according to their natural relationships.

Acknowledgement of the kindnesses of many persons who made the study possible will be made in the larger publication; attention should be called at the present time, however, to the fact that the key is based upon that of Blanchard (1925). A formal bibliography is omitted.

[1] Contribution from the Department of Zoology of the University of Michigan and the Department of Biology of the University of Louisville.

A Key to the North American Forms of *Natrix*

1. Scale rows 19[1] 2
   Scale rows more than 19 6
2. Upper labials 8 ..... *Natrix valida* (p. 175)
   Upper labials 5–7 3
3. Lower labials 7; preocular single ..... *N. kirtlandii* (p. 176)
   Lower labials 9–11; preoculars usually 2 4
4. One long dark median stripe on belly, or no markings except on the ends of ventrals ..... *N. grahami* (p. 176)
   Two long dark stripes near middle of belly, at least anteriorly 5
5. Light ventro-lateral stripes present ..... *N. septemvittata* (p. 176)
   No light ventro-lateral stripes ..... *N. rigida* (p. 176)
6. Scale rows 27–33 (sometimes 25 in *rhombifera*, which has, however, a pattern of alternating dorsal and lateral spots connected by diagonal bars); lower labials usually 11–13 7
   Scale rows 21–25 (rarely 27 in *transversa*); lower labials, usually 10 11
7. Two anterior temporals; a mid-dorsal row of 21–25 isolated quadrate spots[2] ..... *N. taxispilota* (p. 177)
   A single anterior temporal; dorsal spots, if visible, usually connected with lateral spots 8
8. Eye in contact with upper labials; dorsal spots, 26–33; a single series of lateral spots, extending from ventrals to 8th or 9th row of scales, alternating with and usually connected with the dorsal blotches 10
   Eye separated from upper labials by one or more subocular plates; dorsal spots about 50, small and ill-defined; two series of small, often indistinct, lateral spots in alternation, the lower series extending from the ventrals to about the 5th to 7th row of scales 9
9. Lower surface of tail and posterior two-thirds of body heavily marked with dark brown; 41–50 lateral bars; caudals in males 68–78, in females 57–70 ..... *N. cyclopion cyclopion* (p. 177)
   Belly whitish or yellowish, only slightly marked posteriorly; 49–57 lateral bars; caudals in males 80–84, in females 69–78 ..... *N. c. floridana* (p. 177)
10. Ventrals strongly marked with semilunar dark spots; dorsal color pattern usually distinct ..... *N. rhombifera rhombifera* (p. 177)
    Ventrals nearly or quite immaculate; dorsal pattern obscure ..... *N. r. blanchardi* (p. 177)
11. A median (sometimes irregular) row of light spots on belly 12
    No median row of light spots on belly 13
12. Dorsum spotted or unicolor, the spots occasionally tending to form longitudinal stripes, especially anteriorly ..... *N. sipedon compressicauda* (p. 180)
    Dorsum with four longitudinal dark stripes ..... *N. s. clarkii* (p. 180)
13. Scale rows 21 (rarely 23) ..... *N. valida* (p. 175)
    Scale rows 23–25 (rarely 27) 14
14. Body unicolor above 15
    Dorsum with cross bands or spots 16
15. Dorsum grey; belly yellow to cream, dusky posteriorly, especially tail ..... *N. s. insularum* (p. 178)
    Body uniformly dark brown, reddish brown, or black above (or spots faintly visible) in adults; belly yellow or red, immaculate or with dark anterolateral margins of ventrals, but without definite spots, and tip of tail without markings ..... *N. erythrogaster erythrogaster* (p. 181)
16. Belly immaculate or with dark antero-lateral margins of ventrals; tail immaculate beneath, especially toward tip 17
    Lower surface with definite markings; tip of tail never immaculate beneath 18

[1] In all instances, the number of scale rows referred to is the maximum, or the number near the middle of the body.

[2] Throughout the key the number of spots or bands refers to the number on the body anterior to the vent.

17. Neck region with 1–7 cross bands, followed posteriorly by a median series of spots in alternation with a lateral series; this pattern becomes obsolete and uniformly dark with maturity .....Immature *N. e. erythrogaster* (p. 181)
Pattern similar but with 0–2 anterior transverse bands, and not becoming obsolete .....*N. e. transversa* (p. 181)
18. A dorsal pattern of 3–15 anterior transverse bands, posterior to which a series of median dorsal blotches alternates with a series of lateral spots (rarely a complete series of transverse bands, but then belly has half-moon shaped spots); ventrals 128–155 19
Dorsal pattern wholly of transverse bands or rarely with a few alternating spots; ventrals 121–143 20
19. Usually 3–10 (rarely more) anterior transverse bands and a total of more than 30 bands and dorsal spots on body; ventrals 135–155, many with 2 dark or red half-moon shaped marks and with flecking and mottling; dorsal spots and bands generally darker, less distinct from the ground color, and separated by interspaces narrower than those of *pleuralis* (lateral interspaces narrower than lateral bars) .....*N. s. sipedon* (p. 178)
Usually 5–15 anterior transverse bands and a total of fewer than 30 bands and dorsal spots; ventrals 128–146, many with 2 reddish-brown, crescent-shaped marks which are somewhat more restricted than those of *sipedon* and tend more to form 2 longitudinal rows; dorsal spots generally lighter, more distinct from pale ground color, and separated by interspaces wider than those of *sipedon* (lateral interspaces wider than lateral bars)..*N. s. pleuralis* (p. 178)
20. Dorsal bands about 10–18; ventrals 129–138; belly with squarish markings ....*N. s. confluens* (p. 179)
Dorsal bands more than 18; ventrals 120–137; belly with squarish markings or not 21
21. Dorsal bands about 24 (19–33); ventrals 126–137; belly with quadrate dark or red spots; sometimes small lateral spots alternate with the transverse bands .....*N. s. fasciata* (p. 179)
Dorsal saddles about 29 (24–35); ventrals 120–129; belly with reddish or dark anterior borders to ventrals, these often narrowed in center leaving a light area suggestive of the spots of *compressicauda* ....*N. s. pictiventris* (p. 180)

Diagnoses of the North American Forms of *Natrix*

Natrix valida (Kennicott)

Regina valida Kennicott, Proc. Acad. Nat. Sci. Phila., 1860: 334 (Durango, Mexico).
Natrix valida Cope, Proc. U. S. Nation. Mus., 14, 1892: 670.

Range.—Southern Lower California and western Mexico.

Diagnosis.—Although variable in coloration, *N. valida* may generally be recognized by the combination of 19 dorsal scale rows and 8 upper labials, or if there are 21 scale rows the absence of a midventral series of light spots will distinguish it from *N. s. compressicauda* and *N. s. clarkii*. The more usual coloration consists of a rather uniform light grey to brownish-olive back, with more or less black flecking upon the bases of the scales of the fourth and fifth and sometimes first and eighth rows, and a greyish-yellow belly. A less frequent type is nearly black, with a lateral stripe of bluish-grey upon the third, second and part of the first rows of scales, which may expand at intervals into dorsal bars, and the belly is also dark and more or less mottled. Intermediate specimens are known, and the two color phases do not seem to be segregated geographically.

Natrix kirtlandii (Kennicott)

Regina kirtlandii Kennicott, Proc. Acad. Nat. Sci. Phila., 1856: 95 (northern Illinois).
Natrix kirtlandii Cope, Ann. Rep. U. S. Nation. Mus., 1898, 1900: 995, fig. 266.

RANGE.—Wisconsin and southern Michigan south through northern and central Illinois and Indiana to Louisville, Kentucky, and east throughout Ohio to western Pennsylvania.

DIAGNOSIS.—Easily distinguished from other forms with 19 rows of dorsal scales by its strongly marked pattern of spots. On the medium brown ground color of the back are four rows of well defined, dark spots, one on either side of the midline in alternation with another row situated somewhat lower. Some of the scales of the lowest row bear tiny, obscure spots. The belly is pale reddish in living individuals, brownish white in preserved specimens, and bears two rows of distinct, subcircular, blackish spots near the ends of the ventrals.

Natrix grahami (Baird and Girard)

Regina grahami Baird and Girard, Cat. N. Amer. Rept., 1, 1853: 47 (Rio Salado, Texas).
Natrix grahami Cope, Ann. Rep. U. S. Nation. Mus., 1898, 1900: 1991, fig. 264.

RANGE.—Illinois to eastern Kansas and south to Texas and Louisiana.

DIAGNOSIS.—*N. grahami* may be distinguished from other species of *Natrix* having 19 scale rows by the nearly uniform brown coloration of the back, bordered below on the third, second, and upper half of the first scale rows by a cream or straw colored band. The ends of the ventrals and usually the lower portion of the first row of dorsal scales bear a dark, longitudinal stripe. The belly is yellowish or straw colored and usually is marked posteriorly and under the tail by a median row of small dark spots.

Natrix septemvittata (Say)

Coluber septemvittatus Say, Journ. Acad. Nat. Sci. Phila., 4, 1825: 240 (Pennsylvania).
Natrix septemvittata Cope, Trans. Amer. Phil. Soc., 18, 1895: 216.

RANGE.—Pennsylvania, Ohio, Michigan, and Wisconsin south to Alabama and Georgia.

DIAGNOSIS.—*N. septemvittata* is distinguishable from other forms having 19 scale rows by the presence of four dark stripes on the belly, 2 near the midline and 2 lateral, the latter extending onto the lower half of the first row of dorsal scales and bordered above by a yellow lateral band covering the upper half of the first row and all of the second. The remainder of the back is medium brown with 3 more or less distinct, narrow, black stripes. All the dorsal scales are keeled.

Natrix rigida (Say)

Coluber rigida Say, Journ. Acad. Nat. Sci. Phila., 4, 1825: 239 (the "Southern States").
Natrix rigida Cope, Proc. U. S. Nation. Mus., 14, 1892: 668.

RANGE.—South Carolina to western Louisiana, excluding peninsular Florida.

DIAGNOSIS.—Distinguished by the following combination of characters: 19 scale rows, first row of scales smooth, 2 preoculars, 2 rows of spots on belly, and greenish-brown above with a narrow stripe of dark brown on each side of the midline.

Natrix taxispilota (Holbrook)

Tropidonotus taxispilotus Holbrook, N. Amer. Herp., 2nd. ed., 4, 1842: 35, pl. 8 (South Carolina seaboard and the Altamaha River, Georgia).
Natrix taxispilota Cope, Proc. U. S. Nation. Mus., 11, 1889: 392.

RANGE.—Coastal region from North Carolina to central Florida and westward possibly to Louisiana.

DIAGNOSIS.—This large snake is easily recognized by the large number of dorsal scale rows, 27 to 33, rarely 25, the presence of two anterior temporals, the absence of suboculars, the reduced size of the parietals, and the dorsal color pattern of about 25 dark brown, squarish blotches in a median series, separated by spaces about as wide as themselves, and not connected by diagonal lines (as in *N. r. rhombifera*) with the lateral series on each side. The belly is yellowish with markings of deep brown.

Natrix cyclopion cyclopion (Duméril and Bibron)

Tropidonotus cyclopion Duméril and Bibron, Erp. Gén., 7, 1854: 576 (New Orleans).
Natrix cyclopion cyclopion Goff, Occ. Pap. Mus. Zool., Univ. Mich., 327, 1936: 1.

RANGE.—Lowlands of the Mississippi Valley from southern Illinois south to Louisiana, east to Alabama and possibly west along the coast into Texas.

DIAGNOSIS.—*Natrix c. cyclopion* and *N. c. floridana* may be distinguished from other North American species of the genus by the presence of one or more subocular plates and an ill-defined dorsal color pattern of about 50 mid-dorsal bars alternating with a lateral series, which in turn is more or less in alternation with a second and lower lateral series. The typical subspecies is distinguished by having the belly brown, scale rows 27 in males and 29 in females, and caudals averaging 73 in males and 64 in females.

Natrix cyclopion floridana Goff

Natrix cyclopion floridana Goff, Occ. Pap. Mus. Zool., Univ. Mich., 327, 1936: 1 ("near Leesburg, Florida, at the Alsa-Brook Prairie between Lake Griffin and Lake Yale").

RANGE.—Peninsular Florida, northwest to Tallahassee and northeast along the coast to South Carolina.

DIAGNOSIS.—Distinguished from *N. c. cyclopion* by having the belly predominantly yellow or white, scale rows 29 in males and 31 in females, and caudals averaging 82 in males and 73 in females.

Natrix rhombifera rhombifera (Hallowell)

Tropidonotus rhombifer Hallowell, Proc. Acad. Nat. Sci. Phila., 6, 1852: 117 ("Arkansas River and its tributaries near the northern boundary of the Creek Nation").
Natrix rhombifera rhombifera Clay, Ann. Carnegie Mus., 27, 1938: 251–3.

RANGE.—Southern Indiana and Illinois to Alabama and west to Texas and northern Mexico.

DIAGNOSIS.—The diamond-back water snake can be distinguished from many other species of the genus by its large number (25 to 31, usually 27) of scale rows and from all others by the narrow diagonal bars which connect the median dorsal series of spots with the lateral spots in alternation on each side. Its belly is marked with semi-lunar dark spots.

Natrix rhombifera blanchardi Clay

Natrix rhombifera blanchardi Clay, Ann. Carnegie Mus., 27, 1938: 251–3, Pl. 25 (Tamaulipas, Mexico).

RANGE.—Tamaulipas to San Luis Potosí and south to Vera Cruz, Mexico.

DIAGNOSIS.—This southern race is readily distinguished from its northern counterpart, *N. r. rhombifera*, by its immaculate belly, that of *rhombifera* being strongly marked with semi-lunar dark spots and by its paler, more obscure dorsal coloration.

Natrix sipedon sipedon (Linnaeus)

Coluber sipedon Linnaeus, Syst. Nat., 10th ed., 1758: 219 ("North America").
Natrix sipedon sipedon Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1917: 96.

RANGE.—Southern Maine through southern Quebec, southern Ontario, and Wisconsin to eastern Colorado, south to Oklahoma, Tennessee, and northwestern South Carolina.

DIAGNOSIS.—This common snake is likely to be confused with only *N. s. pleuralis*, *N. erythrogaster transversa*, or young *N. e. erythrogaster*. The differences between *sipedon sipedon* and these snakes are discussed in the diagnoses of these forms.

Natrix sipedon insularum Conant and Clay

Natrix sipedon insularum Conant and Clay, Occ. Pap. Mus. Zool., Univ. Mich., 346, 1936: 1.

RANGE.—Pelee and other islands in the western portion of Lake Erie.

DIAGNOSIS.—In size and scutellation this snake is similar to *N. s. sipedon* from which it is readily distinguished by the almost complete absence of a color pattern. The back is nearly or quite uniformly grey, the belly cream white. Intermediate specimens are common.

N. s. insularum may be distinguished from *N. e. erythrogaster* by the duskiness of the subcaudals of the former (those of *erythrogaster* being immaculate, especially near the tip of the tail), and by the grey dorsal coloration (that of *erythrogaster* being reddish-brown to black).

Natrix sipedon pleuralis (Cope)

Natrix fasciata pleuralis Cope, Proc. U. S. Nation. Mus., 14, 1892: 672 (probably Summerville, South Carolina).

RANGE.—South Carolina westward around the southern extremity of the Appalachian Mountains, Mississippi, Arkansas, and southern Missouri, and northward to southern Illinois and southern Indiana.

DIAGNOSIS.—*N. s. pleuralis* is likely to be confused only with *N. s. sipedon* or *N. s. fasciata*. It is more readily distinguished from the latter than from the former. Although typical *pleuralis* and typical *sipedon* are decidedly different and may be differentiated at a glance, the transition is very gradual in the region of the Mississippi Valley, where many intermediate specimens occur. The most striking feature of *pleuralis* is its more widely spaced dorsal and lateral bars upon a relatively lighter ground color. The belly bears crescent-shaped marks similar to those of *sipedon* but these tend to be more definitely in two rows, usually are redder, and remain more distinct in old individuals, whereas those of *sipedon* frequently break down into flecks and mottling. *N. s. pleuralis* usually has fewer than 30 dorsal spots and cross

bands, *sipedon* usually more. The areas between the lateral bars of *pleuralis* are generally wider than the bars, the converse usually holds for *sipedon*.

The transition between *pleuralis* and *fasciata* is more sudden and there are fewer individuals which cannot readily be assigned to one subspecies or the other. *N. s. fasciata* is generally distinguished by having only transverse bands, whereas *pleuralis* usually has transverse bands anteriorly and alternating dorsal and lateral spots posteriorly. Occasional specimens of *pleuralis* have a complete series of transverse bands, but the margins of these are not as serrate as those of *fasciata*. The belly of *fasciata* is characterized by quadrate rather than half-circular markings, and a line from the eye to the angle of the mouth is more pronounced in *fasciata* than in *pleuralis*.

REMARKS.—It is not surprising that this common snake escaped recognition for nearly a half century, when one considers that Cope did not describe it well, make clear its difference from *sipedon*, determine its geographic range, nor ascertain whether his specimens represented a geographic race or a "variety." Furthermore, the identity and locality of the type specimen is a matter of some doubt. The specimen (U.S.N.M. No. 1092, from "Mississippi") designated by Cope as the type does not fit the description and is a *fasciata* recorded in the accession catalog as from Ft. Morgan, Alabama (a locality definitely beyond the range of *pleuralis*). In the same bottle is another specimen which very likely is the one described by Cope, and an old and faded label which seems to bear the inscription "1080 *Nerodia fasciata* B. & G. Summerville, S.C."

Natrix sipedon fasciata (Linnaeus)

Coluber fasciatus Linnaeus, Syst. Nat., 12th ed., 1, 1766: 378 (Carolina).
Natrix sipedon fasciata Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1917: 96.

RANGE.—Coastal region from North Carolina to southeastern Louisiana, excluding peninsular Florida.

DIAGNOSIS.—This snake may be distinguished from the peninsular *N. s. pictiventris*, which it resembles rather closely, by the shape of the ventral markings—squarish spots in *fasciata*, elongate dark areas near the anterior margins of the ventrals in *pictiventris*—and by the presence generally of more than 128 ventrals in *fasciata* and fewer than this number in *pictiventris*.

The dorsal pattern of transverse bands throughout the length of the body will usually distinguish *fasciata* from *pleuralis*, in which most often the posterior portion of the dorsal pattern is composed of alternating dorsal and lateral spots. Furthermore, the belly of *pleuralis* is marked with half-circular spots.

N. s. confluens and *fasciata* may be separated on the basis of the number of dorsal saddles, the former having 11 to 17, the latter about 19 to 30.

Natrix sipedon confluens Blanchard

Natrix fasciata confluens Blanchard, Occ. Pap. Mus. Zool., Univ. Mich., 140, 1923: 1 (Butler County, Missouri).
Natrix sipedon confluens Stejneger and Barbour, Check List N. Amer. Amph. Rept., 3rd ed., 1933: 117.

RANGE.—From the Mississippi River west along the Gulf to about the

98th Meridian and north to southern Oklahoma, central Arkansas, southeastern Missouri and extreme southern Illinois.

DIAGNOSIS.—This species is easily recognized by the number of dorsal cross bands, 11 to 17, which is lower than that of any other American species of *Natrix*. In most other respects, including scutellation and proportions, it is fairly similar to *N. s. fasciata*.

Natrix sipedon pictiventris Cope

Natrix fasciata pictiventris Cope, Amer. Nat., 29, 1895: 677 (Gainesville, Florida).
Natrix sipedon pictiventris Stejneger and Barbour, Check List N. Amer. Amph. Rept., 1917: 96.

RANGE.—Nearly all of peninsular Florida.

DIAGNOSIS.—The typical dorsal markings of this snake consist of a series of 26 to 35 reddish-brown to black cross bands, but in mature individuals the lateral interspaces sometimes become darker than the lateral portions of the cross-bands and thus produce an appearance of alternating dorsal and lateral spots.

For differences between this form and *N. s. fasciata*, see the latter (p. 179). From *N. s. compressicauda* it may be distinguished by the absence or poor delineation of a midventral series of light spots.

Natrix sipedon compressicauda (Kennicott)

Nerodia compressicauda Kennicott, Proc. Acad. Nat. Sci. Phila., 1860: 535 (south of Tampa Bay, Florida).

RANGE.—Coast of the southern half of peninsular Florida and adjacent coast of Cuba, mainly in brackish water.

DIAGNOSIS.—The color pattern of this snake is extremely variable. Its most constant feature is a midventral row of light spots, one on each scute; posteriorly the series may become irregular or indistinct. The back usually has a series of about 30 dark, ill-defined cross-bars, each of which is so expanded and constricted at intervals as to tend to produce longitudinal stripes. The presence of two or four longitudinal stripes is not unusual, especially in the neck region. Some specimens are almost uniformly melanistic, while others are reddish or straw-colored and entirely without dorsal markings. (See second paragraph under *N. s. pictiventris*, above.)

Natrix sipedon clarkii (Baird and Girard)

Regina clarkii Baird and Girard, Cat. N. Amer. Rept., 1, 1853: 48 (Indianola, Texas).

RANGE.—Gulf coast from Levy County, Florida, to San Patricio County, Texas, occurring primarily in brackish water.

DIAGNOSIS.—The following combination of features will distinguish this snake from similar forms: 21 to 23 scale rows at middle of body; belly with a median row of half-circular, yellowish spots, one per scute; back with four longitudinal stripes of deep brown, more or less irregular and separated by narrower areas of yellowish brown.

REMARKS.—Long regarded as a distinct species, this form intergrades with *compressicauda* and occupies an adjacent geographic range. The writer concludes that both *clarkii* and *compressicauda* are geographic races or subspecies of the complex and wide ranging *Natrix sipedon*, which is to be discussed in detail in a later paper.

Natrix erythrogaster erythrogaster (Forster)

Coluber erythrogaster Forster, in Bossu, Travels through North America, 1, 1771: 364 footnote.
Natrix erythrogaster erythrogaster Burt, Amer. Mid. Nat., 16, 1935: 333, (part).

RANGE.—Eastern Texas, eastern Oklahoma and southeastern Kansas eastward throughout the southern states (excluding peninsular Florida) and north to Pennsylvania, Ohio, and extreme southern portions of Michigan and Wisconsin.

DIAGNOSIS.—A medium sized or large snake, reddish-brown to nearly black above and yellowish or reddish, without definite markings, beneath. Individuals in the region of the lower Mississippi Valley and westward usually have yellow bellies, while those to the east and north are red beneath.

Although adults are practically unicolored above, young individuals have dorsal and lateral markings not unlike young *N. e. transversa,* from which they are distinguished with difficulty (see below). In *erythrogaster* the ground color darkens gradually with growth, finally obliterating the markings; in *transversa* the pattern usually persists.

The juvenile pattern of *erythrogaster* likewise bears some resemblance to the markings of *N. sipedon sipedon,* but these two forms may be distinguished by the pigmentation of the lower side of the tip of the tail in *sipedon,* while it is almost immaculate in *erythrogaster.* The dorsal neck bands are fewer in *erythrogaster* (see description of *sipedon,* page 178).

Natrix erythrogaster transversa (Hallowell)

Tropidonotus transversus Hallowell, Proc. Acad. Nat. Sci. Phila, 1852: 177 ("Creek boundary, found near the banks of the Arkansas and its tributaries").
Natrix erythrogaster transversa Taylor, Univ. Kansas Sci. Bull., 19, 1929: 58.

RANGE.—Western Missouri and eastern Kansas through western Oklahoma to southeastern New Mexico, east to Ft. Worth and Houston, Texas, and south to Nuevo Leon, Mexico.

DIAGNOSIS.—A fairly large snake with dorsal color pattern of three series of subquadrate, greyish-brown spots, the median series alternating with the lateral series. The ground color is decidedly lighter than the spots in young individuals, less so in old specimens. On the neck one or two pairs of lateral spots may be adjacent to and continuous with the dorsal spots, thus forming cross bands. The belly is yellowish (whitish in young individuals) and almost without definite markings.

N. e. transversa may be distinguished from adult *N. e. erythrogaster* by the evident pattern of dorsal spots—or at least by the regular, transverse, light interspaces—and by the yellow belly (except from yellow-bellied, western specimens of *erythrogaster,* which however are nearly or quite uniformly dark above). It is more difficult to distinguish between the young of these two subspecies, but they may usually be separated by the number of transverse bands on the neck, which in *erythrogaster* generally is more than three; by the more contrasting color pattern of *transversa;* and the occasional occurrence in *transversa* of 27 dorsal scale rows at midbody and 25 anteriorly, exceeding the maxima of 25 and 23 at these points in *erythrogaster.*

N. e. transversa may readily be differentiated from *N. sipedon sipedon* by the immaculate caudals near the tip of the tail, by the presence of not more than three neck bands (in *sipedon* there are 4 to 10 or more cross bands), by the absence of semi-lunar spots on the ventrals, and by ventrals usually more than 145, usually less in *sipedon*.

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The Snakes of the Genus *Sonora* in the United States and Lower California[1]

By WILLIAM H. STICKEL

NO previous taxonomic study of an inclusive nature has been made of the group of difficult little North American snakes placed in the genus *Sonora*. Many years ago Dr. Frank N. Blanchard noticed that there were signs of differentiation on an east-west axis, but had too few specimens to attempt a revision of the group. At his suggestion, the writer has studied the genus; and several times as many specimens have been examined as have been available to any other one person.[2]

Certain results of the study are presented at this time so that those interested in the genus may use them. Consideration of extralimital species, relationships and variation have been omitted from this note, which is intended to clarify the status of named forms and to describe others regarded as new.

In recent treatments of the genus, *taylori, semiannulata* and *occipitalis* have been recognized, though the latter two are not correctly separated, despite the distinctive morphological adaptation of *occipitalis* to living in sand. *S. semiannulata* of current lists is a complex of several forms of varying distinctness, and has in consequence been assigned an excessively wide range. In this paper the *semiannulata* complex is analyzed into seven forms, and *occipitalis* and *taylori* are rediagnosed. The author will welcome criticisms of his arrangement in the hope that any subsequent paper may benefit from them.

[1] Contribution from the Department of Zoology of the University of Michigan.

[2] Especial indebtedness is felt toward Dr. F. N. Blanchard, Dr. H. K. Gloyd, Mr. L. M. Klauber and Dr. E. H. Taylor for their constant helpfulness. I also wish to extend my sincerest thanks to the following people for their generous aid with specimens or information: Mr. K. P. Schmidt, Mr. Arthur Loveridge, Dr. G. K. Noble, Mr. C. M. Bogert, Dr. Leonhard Stejneger, Dr. Doris Cochran, Dr. A. H. Wright, Mrs. Helen Gaige, Dr. Carl L. Hubbs, Dr. Hobart M. Smith, Mr. Stanley Mulaik, Mr. A. W. Dorgan, Dr. Vasco Tanner, Dr. Angus Woodbury, Dr. Jean Linsdale, Dr. Howard Hill, Mr. Joseph Slevin, Dr. R. B. Cowles, Dr. Willis H. Rich, Mr. C. D. Bunker, Miss Ura Terry, Mr. M. Graham Netting, Dr. Walter J. Williams, Dr. Charles E. Burt, Mr. Roger Conant, Mr. Joseph Bailey, Dr. Emmet R. Dunn, Mr. Edwin D. McKee, the late Dr. Walter Mosauer, Mr. H. W. Parker, Dr. Gordon L. Walls, Mr. George A. Moore, Mr. Earl Sanders, Mr. P. D. Evans and Miss Edith R. Force.

USE OF THE KEY.—The number of dorsal scales should first be counted at about the end of the first fourth or fifth of the length of the body, close enough to the head to determine reduction when this occurs unusually far forward. The count, however, should not be made on the neck, where high counts would be obtained. The posterior count should be made about ten ventral scutes in front of the vent, since back of that point there is occasionally an irregular variation on the sides. In doubtful cases counts should be taken until the condition is understood, remembering that the characteristic reduction is only mid-dorsal.

In using the key all of the data presented should be considered carefully, and with attention to detail, or it may fail. The distinctions stated in the key serve to identify more than 90 per cent of the specimens seen by the writer.

KEY TO THE SPECIES OF *Sonora* IN THE UNITED STATES AND LOWER CALIFORNIA

1. Snout normal; abdomen rounded or but slightly angulate; scale rows various..... 2
   Snout distinctly flattened and attenuated; abdomen strongly angulate; scale rows 15–15 ..... *S. occipitalis*
2. Anterior scale rows 15, rarely 14 or 16 3
   Anterior scale rows 13, rarely 14; ventrals in males 126–139, in females 136–148 ..... *S. taylori*
3. Scale rows near anus 15 or 14; color various 4
   Scale rows near anus 13; color all brownish; ventrals in males 150–155 (av. 152.5), in females about 164; caudals in males 43–48 (av. 45.5), in females about 39 ..... *S. mosaueri,* sp. nov.
4. Scale rows near anus 15 in 90 per cent of specimens, but 14 in 10 per cent; ventrals in males 134–155 (av. 147), in females 140–162 (av. 153); caudals in males 39–52 (av. 43.5), in females 31–44 (av. 37); unicolor, bicolor, streaked, or with 1–25 dark cross bands on body exclusive of tail .....*S. episcopa*
   Scale rows near anus 14, very rarely 15 or 13; ventrals OR caudals running distinctly higher 5
5. Ventrals in males 153–168 (av. 161), in females 162–183 (av. 172); caudals in males 41–57 (av. 53), in females 37–54 (av. 47) 6
   Ventrals in males 147–155 (av. 151), in females 157–166 (av. 160); caudals in males 53–59 (av. 56), in females 46–51 (av. 48.5); color varying from unicolor to a regular series of 28–42 dark cross bands on body ..... *S. semiannulata blanchardi,* subsp. nov.
6. A regular series of dark cross bands present 7
   No series of bands present..... 8
7. Most of the body bands meeting across the abdomen; lateral scales heavily shaded with gray .....*S. semiannulata gloydi,* subsp. nov.
   Bands not meeting across abdomen, or only a few so meeting; lateral scales lightly shaded with gray, or not shaded .....*S. s. semiannulata*
8. Caudals in males more than 49, in females more than 41 ...(*S. miniata,* sp. nov.) 9
   Caudals in males fewer than 49, in females fewer than 41....*S. mosaueri,* sp. nov.
9. A sharp-edged dorsal pink stripe present; stripe contrasting with the bluish-gray to brownish-gray lateral scales ..... *S. miniata linearis,* subsp. nov.
   Dorsal pink stripe absent or blending gradually with the grayish to reddish color of the sides .....*S. m. miniata,* subsp. nov.

Sonora occipitalis (Hallowell)

Rhinostoma occipitale Hallowell, Proc. Acad. Nat. Sci. Phila., 1854: 95.
Lamprosoma annulatum Baird, U. S. Mex. Bound. Surv., 1859: 22 (Colorado Desert).

TYPE LOCALITY.—Mohave Desert of California.

DIAGNOSIS.—A *Sonora* with angulate abdomen, extended spade-like snout,

and always with dark bands on body and tail. The posterior maxillary teeth are not particularly enlarged and the nasal is single, as in all sonoras of the United States. The character most often used to separate this species from *semiannulata*, i.e., whether the bands encircle or not, is invalid, as each species often resembles the other on this basis. Equally or more useless for diagnosis is the number of ventrals.

RANGE.—Known from the following localities. ARIZONA: Yuma, Mohave, Maricopa (from near Aguila and Gila Bend), Pima (Tucson) and Pinal (Picacho) counties. CALIFORNIA: Imperial, eastern San Diego, Riverside, San Bernardino, Los Angeles (near Palmdale and east of Llano near San Bernardino Co. line), Kern (south and east of Tehachapi Mountains), and Inyo counties. NEVADA: Clark County (Boulder City).

REMARKS.—Contrary to frequent statements the range of this form appears to be restricted to the region of the Colorado and Mohave deserts and adjacent regions in southern Arizona. The single Utah record is for a specimen with vague locality brought in by a student to Dr. R. V. Chamberlin. I cannot consider Utah within the range on this evidence. The only other extralimital record, from Boulder, Colorado, must be in error.

Sonora taylori (Boulenger)

Contia taylori Boulenger, Cat. Sn. Brit. Mus., 2, 1894: 265, pl. 12, fig. 3.

TYPE LOCALITY.—Duval Co., Texas, and Nuevo Leon, Mexico.

DIAGNOSIS.—A species of *Sonora* with rounded abdomen and normal snout, characterized by 13–13 scale rows, and by having the lowest number of ventral scutes in the genus, as stated in the key. The color is brown, consistently without bands, and the heads of some specimens are darkened on the parietal region.

RANGE.—The records I have are as follows. MEXICO: Nuevo Leon. TEXAS: Hidalgo (Edinburg), Cameron (Brownsville), Duval (San Diego and vicinity), Bexar (Helotes) and Calhoun (Green Lake) counties.

REMARKS.—Two females examined have more than 13 scale rows, but the number is reduced to 13 posteriorly by mid-dorsal dropping. In such variants the number of ventrals will aid in identification.

Sonora episcopa (Kennicott)

Lamprosoma episcopum Kennicott, U. S. and Mex. Bound. Surv., 1859: 22, pl. 8, fig. 2.
Contia episcopa torquata Cope, Bull. U. S. Nat. Mus., 17, 1880: 21 (northwestern Texas).
Contia nuchalis Schenkel, Verh. Nat. Ges. Basel, 8, 1901: 162 (Fort Worth, Texas).

TYPE LOCALITY.—Eagle Pass, Maverick Co., Texas.

DIAGNOSIS.—A species of *Sonora* with rounded abdomen and normal snout, characterized by 15–15 scale rows and the lowest number of ventrals and caudals of any 15-rowed species of the genus with which it could be confused. The color is phenomenally variable: plain, streaked, striped, barred, collared; gray, brown, black, red. Combinations and intermediates of all these variations have been seen from one locality.

RANGE.—This is primarily an inhabitant of the Great Plains region. It is found from central Texas on the Rio Grande north to southeastern Kansas and west to extreme eastern Colorado and New Mexico.

REMARKS.—This snake does not seem to enter the Trans-Pecos region of Texas, and there is no evidence that it intergrades with either *taylori* or *blanchardi*. In about 10 per cent of the specimens the rows drop to 14 posteriorly, and then the number of ventrals and caudals must be utilized for proper identification. The loreal is absent on one or both sides in enough specimens to make it a slightly weak key character.

This is by far the commonest species of the genus and with *occipitalis* comprises most of the museum specimens.

Sonora semiannulata semiannulata Baird and Girard

Sonora semiannulata Baird and Girard, Cat. N. Amer. Rept., Pt. 1, 1853: 117.
Contia isozona Cope, Proc. Acad. Nat. Sci. Phila., 1866: 304 (Fort Whipple, Arizona).

TYPE LOCALITY.—"Sonora, Mexico."

DIAGNOSIS.—A *Sonora* with normal snout, and with abdomen not angulate. Scale rows 15 (or very rarely 16) anteriorly, reducing mid-dorsally to 14 posteriorly. Black bands consistently present on body and tail, and usually encircling tail. The ventrals average 160 for males and 171 for females; the caudals average 52 and 46 respectively. The number of ventrals best separates this form from *blanchardi*, though there is some overlap; however, of those having ventrals few enough for confusion, three of the six females have too few caudals for *blanchardi*, and there are too few caudals in all three males with overlapping ventral count.

RANGE.—Known from the following localities. ARIZONA, UTAH and NEVADA: Scattered localities. CALIFORNIA: Inyo County. IDAHO: Snake River region. MEXICO: Sonora (type specimen only).

REMARKS.—The data are based on 47 males and 34 females. This form, as here defined, may be composite. Grave doubt pertains to the type specimen from Sonora. Not only are the head scales atypical, but the number of caudals is far lower than in any other specimen referred to the species. In the absence of other material from Sonora, and since no specimens similar to the type have appeared anywhere, the writer is at present averse to basing any change in taxonomy on this one individual, which may be aberrant. More material from northern Mexico is essential to an understanding of this and other problems in the genus.

Sonora semiannulata ***blanchardi,*** subsp. nov.

TYPE.—MZUM[3] 83122, collected by F. N. Blanchard and J. T. Carney, September 28, 1935, on northeastern slopes of the Chisos Mountains, Brewster County, Texas.

PARATYPES.—TEXAS: Brewster Co., MZUM 83123–6, north or northeastern slopes of Chisos Mts.; MZUM 83127–8, Castolon, 15 miles south of Terlingua; FMNH 26611, Green Gulch, Chisos Mts.; KU 14164, near Glenn Spring, 10 miles southeast of the Chisos Mts.; KU 14165, Glenn Spring, 9 miles south of Chisos Mts.; SM (unbanded specimen) Hot Springs;

[3] Abbreviated references to collections made in this paper are: MZUM, Museum of Zoology, University of Michigan; FMNH, Field Museum of Natural History; KU, Kansas University; MVZ, Museum of Vertebrate Zoology; SDSNH, San Diego Society of Natural History; CAS, California Academy of Sciences; NPS, National Park Service; SM, private collection of Stanley Mulaik; Chi. AS, Chicago Academy of Sciences; LMK, private collection of L. M. Klauber; ES, private collection of Earl Sanders; EHT, private collection of E. H. Taylor; USNM, U. S. National Museum; UCLA, University of California at Los Angeles.

NPS, Government Spring. MEXICO: EHT 4681, 20 miles south of Chihuahua City, Chihuahua.

DIAGNOSIS.—Snout and abdomen of normal shape; 15 scale rows anteriorly and 14 posteriorly; ventrals fewer than in *semiannulata* and caudals higher than in *episcopa* (for figures see key). The color may be uniform brownish or grayish or may have bands as in *semiannulata,* or may show intermediate conditions in which the bands are only partially present.

DESCRIPTION OF TYPE.—Female; total length 237 mm., tail 48 mm.; ventrals 158; caudals 47; scale rows 15 anteriorly, dropping to 14 at the distance of 102 mm. from end of snout; scale pits single, very faint, apparently absent from most scales; head scales normal; temporals 1–2 on each side; right labials 7 and 6, left labials 7 and 7; left supraocular in type with a slight notch on posterior outer edge; anterior chin shields in contact with first three infralabials of each side and with the single small scale separating the posterior chin shields; eight irregular rows of small scales between anterior chin shields and first ventral; the fourth infralabial the only one of the series touched by the posterior chin shields; the ventrals just anterior to anal shields divided, one on the right side and two on the left; caudals all divided; tail complete.

Head darker than body; extreme posterior ends of parietals light colored; dorsal scales with irregular brown mid-portion on tan ground, microscopically speckled with brown; margins of scales brownish and hyaline; most scales with dark apical spot; lateral scales similar but progressively lighter toward abdomen; ventral scutes with dorsal coloration on ends; a few ventrals and several caudals with a little yellow marking.

RANGE.—Known from the following localities. TEXAS: El Paso (El Paso and vicinity) and Brewster (around Chisos Mts. and along Rio Grande) counties. NEW MEXICO: Sierra (Elephant Butte Dam) County. MEXICO: Lake Santa Maria and a point 20 miles south of Chihuahua City, Chihuahua.

REMARKS.—The scale counts will usually identify this form quite easily despite the considerable range of coloration. The characters differentiating the race are best shown by specimens from Brewster County, Texas, for in El Paso County there are indications of intergradation with *semiannulata.* It is probable that intergradation occurs across southwestern New Mexico, though specimens are not at hand from this region. The complex questions of relationships to which knowledge of this intergradation gives rise cannot be discussed here.

The data are based upon 15 males and 18 females.

In naming this snake for Dr. F. N. Blanchard I can but partially signify the admiration felt by all of his students for his very unusual interpretive and critical ability.

Sonora semiannulata ***gloydi,*** subsp. nov.

TYPE.—MZUM 83754, collected by Mr. William Holzmark in 1936 on the Bright Angel Trail, Lower Sonoran level of the Grand Canyon, Grand Canyon National Park, Arizona.

PARATYPES.—Grand Canyon National Park, Arizona: Grand Canyon National Park collection 107, vicinity of Indian Gardens; UCLA 32, mouth

of Garden Creek; MVZ 17580, Bright Angel Trail.

DIAGNOSIS.—Morphologically like *S. s. semiannulata,* from which it differs in coloration. The black bands are wider than the interspaces on the back and extend downward onto the ventrals; most of the bands completely cross the abdomen, though they are more diffuse ventrally than dorsally. The scales of the interspaces are heavily shaded with dark gray except sometimes for the lower and median rows.

DESCRIPTION OF TYPE.—Female; total length 350 mm., tail 61 mm. lacking tip; ventrals 178; caudals 48 lacking tip; scale rows 16– (probably abnormal) 15–14, the drops occurring 165 mm. and 249 mm. from the snout, respectively; scale pits single, small, present on most dorsal scutes; oculars 1–2, upper postocular the larger; left temporals 1–1, right 1–2; left supralabials 6 (fifth fused to what is normally sixth), right 7; infralabials 7–7; posterior chin shields separated by a small scale; 7 irregular rows of small scales between posterior chin shields and first ventral; first ventral with one small scale on each side, second ventral with small scale only on right side.

Head dark gray; upper lip light; lower jaws and throat light; 26 black bands on body, 6 on tail; body bands extend onto ventrals in dilute and somewhat narrowed condition, and about 19 meet across the belly, thus ringing the body; tail encircled by all its bands; the dorsal scales between bands almost all dark brownish-gray with light borders; scales in bands faintly light-edged in lowest 2–3 rows; belly light between bands.

RANGE.—Except for intergrades, this form is known only by the type and paratypes, all of which are from the Grand Canyon.

REMARKS.—A good series of *semiannulata* from St. George, Washington Co., Utah, is closer to *gloydi* than to the typical subspecies in coloration, and is believed to prove intergradation. A specimen from Boulder Dam, Mohave Co., Arizona, shows somewhat less resemblance toward *gloydi.*

Comparison with the paratypes indicates that the type is probably unusual in lacking the dark head crescent and in having practically all the scales between the body bands heavily darkened.

It is a very real pleasure to name this snake in honor of Dr. Howard Kay Gloyd.

Sonora ***miniata miniata,*** sp. and subsp. nov.

TYPE.—Chi. AS 5139, from 2 miles northwest of Mesa, Arizona, collected by Earl Sanders.

PARATYPES.—Mesa, Arizona: Chi. AS 5140, 3 miles north of Mesa; ES, 19 specimens (nos. 1–19), Mesa and vicinity.

DIAGNOSIS.—The species as a whole is differentiated from *semiannulata,* to which it is structurally similar, by the absence of bands on body and tail, and the lack of the black head crescent which is usually evident in *semiannulata.* No specimens showing an intermediate coloration are known. From *episcopa* it differs in having the scale rows 15–14 instead of 15–15 and in the much higher number of ventral and caudal scutes.

The subspecies *miniata,* especially, and to a lesser extent *linearis,* is further separated from *semiannulata* by the fact that the shading on the posterior two-thirds of the head extends over the nape for one to four rows and well down onto the sides of this part of the neck. This dark crown and

nape has not been seen in *semiannulata*. Such occipital darkening is very prominent in the young, where it may be black, but is obscure in some individuals. The race *miniata* is gray or reddish gray in immaturity, but the adults vary from solid gray to reddish brown or uniform pinkish. In some specimens the middle of the back is lighter and pinker than the sides, suggesting the subspecies *linearis*, but the bicoloration is less pronounced and the dorsal stripe is not sharp-edged; rather, it merges gradually with the lateral coloration.

DESCRIPTION OF TYPE.—Female; total length 329 mm., tail 59 mm.; ventrals 173; caudals 45; scale rows 15–14, the reduction being mid-dorsal and at a point 94 mm. behind the snout; scale pits apparently absent; scales on top of head normal; preoculars, right one, left two; postoculars, right two, left one, the dorsal one fused with supraocular; temporals 1–2 on each side, second dorsal temporal of right side in type fused to scale behind it; supralabials 7, second left supralabial in type with large notch; infralabials 6, fourth largest, sixth longest; posterior chin shields very small, separated by one scale, touching fourth infralabials; about 7 rows of small scales between anterior chin shields and first ventral; first two ventrals reduced, flanked by small scales.

Snout to frontal faded pink; light grayish tan from frontal to two scales behind parietals and down to level of mouth-angle; abdomen and sides creamy, becoming pinkish tan dorsally (in alcohol); scales with diffuse brown bases, save for median 2–3 rows.

RANGE.—Specimens assigned to this form have been seen from the following places. ARIZONA: Maricopa (Mesa and vicinity, Phoenix, near Aguila, near Wickenburg), Mohave (Kingman), Yavapai (Prescott, near Congress Junction), Pima (region of Santa Catalina Mts.) counties. IDAHO: Ada County (Snake River Canyon).

REMARKS.—Despite the fact that *miniata* and *semiannulata* are separated upon color alone, they are known to occur together at only four localities: Prescott, Phoenix and Yuma in Arizona, and the Snake River in Idaho. Good series of each are at hand from places in which the other has not been found, and many scattered localities of both do not duplicate. At Yuma, *miniata* far outnumbers *semiannulata*: the latter may occasionally follow or be carried down the Colorado River to that point. The data hint at an ecological separation, so new specimens should bear ecological and very exact locality data.

In the two dozen specimens seen from Mesa there were none of the *semiannulata* type and practically no approach to *linearis*. The present concept of the subspecies is based chiefly on this series. Isolated specimens give but a poor idea of the population, so material from all western Arizona must be viewed as tentatively placed here until the intergrading area with *linearis* is better known. The Chicago Academy of Sciences series from near Wickenburg resembles *linearis* more than the Mesa material does, but is predominantly *miniata*. At Yuma the population is more strongly *linearis* and may be regarded as intergrading. Of the 32 specimens of *linearis* and the 53 of *miniata* examined, excluding the individuals from Yuma, the diagnostic characters will separate about seven-eighths into the proper subspecies.

The name *miniata* refers to the vermilion color so conspicuous, at least dorsally, on most adults of the species.

Sonora miniata ***linearis,*** subsp. nov.

TYPE.—LMK 2013, from Seeley, Imperial County, California, collected by Chas. McHone, July 15, 1929.

PARATYPES.—Imperial Co., California: LMK 109, 1743, 8506, 23647; MVZ 5610; SDSNH 14518, 13729; CAS 64587–8; KU 6663.

DIAGNOSIS.—Structurally similar to *miniata miniata,* but distinguished from it by having a distinct dorsal stripe, usually quite sharp-edged, contrasting in color with the sides. In life the stripe is vermilion, in preservative salmon to cream. The sides are bluish gray to brownish gray, instead of reddish to brown.

DESCRIPTION OF TYPE.—Female; total length 376 mm., tail 66 mm.; ventrals 180; caudals 47; scale rows 15–14; many scales with irregular scattered depressions, but apical pits apparently absent; head scales normal; oculars 1–2; temporals 1–2; supralabials 7; infralabials 7, fifth right infralabial in type larger than the left and with a posterior projection; posterior chin shields much smaller than anterior, touching fourth labials and barely reaching third on right; 8 rows of small scales between anterior chin shields and first ventrals.

Scales of sides brownish gray with light edges and occasionally with black apical spots; head light brownish gray, darker in middle of parietals and postero-lateral to them; dorsal stripe two scales wide, sharpest on posterior half of body where it cuts cleanly through the middle of scales; scales in stripe lightly clouded with brown, cream colored (in preservative); stripe continued to near end of tail.

RANGE.—Known from the following localities. ARIZONA, Yuma County (specimens are most closely related to *linearis* but are considered intergrades). CALIFORNIA: Imperial, Riverside and San Bernardino (near Blythe Junction) counties. NEVADA: Pershing County (between Pleasant and Dixie Valleys). MEXICO: Lower California (Mt. Mayor Cocopah in Cocopah Range).

REMARKS.—The darkness of the head and nape is less distinct in most specimens than in *miniata.*

The precise relationship and degree of intergradation with *miniata* require further attention.

Sonora ***mosaueri,*** sp. nov.

TYPE.—MVZ 13772, Comondu, Lower California. Collected April 2, 1931, by C. C. Lamb.

PARATYPES.—Comondu, Lower California: MVZ 13770–1, 13773.

DIAGNOSIS.—A *Sonora* with normal snout, rounded belly, uniform coloration, 15 scale rows anteriorly, dropping successively to 14 and 13, the middorsal row being lost first, followed by an adjacent row. If the number of dorsal scales should prove inadequate for identification when more specimens are at hand, the numbers of ventrals and caudals will help, as indicated in the key.

DESCRIPTION OF TYPE.—Male; total length 328 mm.; tail 58 mm. lack-

ing tip; ventrals 154; caudals 43 with tail-tip incomplete, as shown also by the tail-body ratio of .176; scale rows just behind head 19, rapidly reducing on neck to 15 by omission of lateral scales; mid-dorsal row dropped opposite 76th ventral, and opposite 102nd ventral another dorsal row is lost, leaving the formula 15–14–13; most scales with very minute pit just distal to a tiny brown spot, but not in the spot (the pits can best be seen by magnification and oblique lighting); scales normal on top of head; rostral, nasals and loreals normal; oculars 1–2; temporals 1–1 on right, 1–2 on left (a large irregular scale present on both sides above and behind second temporals in type); supralabials 7; infralabials 7, 4th the largest and the only one touching posterior chin shields; posterior chin shields about half the size of the anterior pair and separated by two small scales; about six irregular rows of small scales between chin shields and ventrals.

Color of back and sides in alcohol a medium grayish brown extending slightly onto the ventrals and caudals; dorsal scales with light margins, and with numerous minute brown specks overlying the more diffuse brown pigmentation; a small brown spot on the end of most scales; the first rows of lateral scales lighter than the other rows; ventral color a faded yellowish white interrupted along the mid-ventral line of the tail by a diffuse brown streak; upper lips light in color back to the sixth labial.

Variation in the Paratypes.—Ventrals 151, 152, 153; caudals 45, 47, 48; tail-body ratios .189, .190, .192. In 13773 the dropping of the first scale row occurs so far forward that Linsdale[4] attributed 14 rows to the specimen. The scales of the temporal region behind the first temporal are subject to wide variation in size and shape. The scales of the back tend to be darker at the base, particularly in two specimens, and in 13773 the lower surface of the tail is faintly mottled with brown.

Range.—Known with certainty from the type series alone.

Remarks.—The type series contains only males. A female, USNM 67381, from "Lower California," is similar to the Comondu specimens except that it fails to reduce from 15–14 to 15–14–13. It is possible that the females of this species never or seldom reduce to 13 rows. Mocquard[5] recorded nine specimens of *"Contia episcopa"* from Lower California, of which seven came from Santa Rosalia (no specific locality was given for the other two). Since he gave but a single dorsal count, 15 for each specimen, it is difficult to be sure of the identification. However, if they belong to this form, and if Mocquard's counts are accurate, it is evident that his specimens have the ventrals and caudals considerably more numerous than have the ones from Lower California examined by me. Because identification and verification of these specimens has not been made, Mocquard's data have not been used in preparing the key or diagnosis.

This species is dedicated to the memory of Dr. Walter Mosauer, whose work on desert reptiles and the musculature of snakes greatly increased our knowledge of reptilian ecology and ophidian relationships.

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[4] *Univ. Calif. Publ. Zool.*, 38, 1932: 380.
[5] Nouv. Arch. Mus. Hist. Nat. Paris, ser. 4, mem. 1, 1899: 319-320.

Notes from a Herpetological Diary, I

By L. M. Klauber

In recording field notes and other herpetological observations, one frequently comes upon odd items of general interest which do not fit into the scope of any contemplated papers, whether faunistic or taxonomic. While I have published several series of field notes (Bull. Zool. Soc. S.D., 8, 1931: 68–81; 9, 1932: 75–82; Copeia, 1932: 118–128), I find at hand an additional accumulation, which are believed to warrant publication.

An Addition to the Fauna of Utah.—On May 17, 1936, I found dead on the road 1 mile east of Saint George, Washington County, Utah, a half-grown specimen of *Arizona elegans occidentalis*. This, as far as I know, is the first reported from that state. It was to be expected there, as the herpetological fauna of this corner of Utah is Lower Sonoran in character. In fact I had been out the night before with Dr. D. E. Beck, hoping to find *Arizona* and *Phyllorhynchus*, but without success.

This *Arizona* does not seem to differ in any important detail from the specimens found in the Mohave Desert of California. The scale counts are as follows: Scale rows, 27; ventrals, 221, anal entire; caudals, 54; supralabials, 8; infralabials, 14–12; preoculars, 2–1; postoculars, 2–2; temporals, 2 + 3; male. There are 61 blotches on the body, 19 on the tail. The blotches are 9 to 10 scale rows wide and 2 scales (end to end) long. In color this snake is somewhat darker than most desert specimens, but not as dark as the coastal individuals. The ground color is brown with a reddish tint.

Cedros Island Worm Snake.—Until recently there has been available from Cedros Island only a single specimen of worm snake. This was a dried specimen (CAS 8860) in such a poor state of preservation that it was difficult to fix its subspecies, since the scale count (as nearly as it could be determined) indicated *Leptotyphlops humilis slevini*, while the color resembled that of *L. h. humilis*. (Trans. S. D. Soc. Nat. Hist., 6, 1931: 345.)

Through the courtesy of Mr. C. B. Perkins I recently obtained a live specimen from the island. In every particular this falls within the *L. h. humilis* classification. The dorsal scales number 275, the L/D ratio is 55, and 7 dorsal scale rows are dark brown in color, especially at the scale edges.

A Skin-Shedding Rendezvous.—On September 2, 1937, I was hunting for garter snakes on a small stream near Camp Richardson on Lake Tahoe, El Dorado County, California. Only a single recently-born specimen of *Thamnophis ordinoides elegans* was collected, but around a boulder about 2 feet in diameter I found from 10 to 12 recently shed skins, probably of the same species. The noteworthy point seemed to be the fact that there was much brush and other boulders hereabouts, and I could determine no reason why the snakes should have concentrated on this particular rock for skin-changing.

THE SUBSPECIES OF THE SPOTTED NIGHT SNAKE.—Dr. E. R. Dunn in his *Notes on North American Leptodeira* (Proc. Nat. Acad. Sci., 22, 1936: 689–698) includes in that genus the spotted night snakes hitherto classified as a separate genus, *Hypsiglena*. He lists three subspecies: *Leptodeira torquata torquata, L. t. venusta,* and *L. t. ochrorhyncha*. Concerning the desirability of combining these two genera I have no opinion to offer; however, I have available a considerable collection of night snakes from the Californias and believe that the invalidity of *venusta* may be demonstrated.

Dr. Dunn segregates *venusta* (type localities Santa Rosalia and San Ignacio, Lower California) from *ochrorhyncha* (type locality Cape San Lucas, Lower California), by means of ventral scale counts, assigning the range 178–186 to the former and 167–175 to the latter. I find the entire range from 166 to 191 covered within the single restricted area of western (cismontane) San Diego County. It is true that there is an evident correlation between habitat and scale counts, desert areas producing a higher ventral count than more humid regions, but this character is so variable in *ochrorhynchus* that to classify on it would lead to an entirely illogical geographical arrangement. The situation is further complicated by a considerable sexual dimorphism.

The only locality from which enough specimens are available to permit a fairly accurate estimate of the characters of the parent population is western San Diego County (coast to mountains), from which area 69 specimens are at hand. We have the following statistics of the ventral scale counts:

	MALES	FEMALES
Number of specimens	39	30
Extreme range	166 – 184	169 – 191
Interquartile range	171.6 – 176.9	176.2 – 182.5
Mean	174.23 ∓ 0.63	179.37 ∓ 0.85
Coefficient of variation, per cent	2.24	2.60

We see that the average sexual difference amounts to about 5 scales. The total range exceeds that cited by Dunn for both *ochrorhyncha* (167–175) and *venusta* (178–186). In the city of San Diego alone specimens have been found ranging from 169 to 186, thus practically overlapping both forms.

That *ochrorhyncha* varies considerably in ventral scale counts in different areas, there is no doubt; the point is that this variation is so interwoven territorially that it is impossible to produce a logical or consistent arrangement of geographical races.

For example, in the foothills of San Diego County the ventral scale count seems slightly higher than on the coast, although there are insufficient specimens to prove this definitely. On the desert side of the mountains there is an unquestioned increase (coincident with a lighter ground color), for 11 desert males average 185.5 (range 180–189) and 2 females average 187.5 (range 183–192).

Northward in California the Mohave Desert and San Joaquin Valley produce specimens with high counts; the coastal specimens are usually low, yet the most northerly specimen, CAS 30876 from Contra Costa County, is a female with 193 ventrals. The highest ventral count of any specimen

available to me is a female from Frink Springs, Imperial County, with 194 ventrals.

Lower California mainland specimens vary from 167 to 186. Arizona specimens run from 164 to 188. Of these the lowest is a male (SDSNH 15837) from Pinery Canyon, Chiricahua Mountains; the highest a female from an unknown location (CAS 33841). There are not sufficient specimens available to determine whether the scale counts correlate with life zones in Arizona.

In Utah and Idaho the variation is from 177 to 199. The specimen with 199 I have not seen; it is mentioned by Woodbury (Bull. Univ. of Utah, 21, 1931: 96).

I think it evident that as far as classification based on ventral scale counts is concerned, the subspecies *venusta* is not a tenable form.

THE RANGE OF *Xantusia arizonae*.—The type locality of *Xantusia arizonae* is in the Weaver Mountains, one mile south of Yarnell, Yavapai County, Arizona, this being the only point from which the species has been reported. More recently I have obtained specimens in the McCloud Mountains, 3 miles north of Hillside, Yavapai County, Arizona. This extends the range 20 miles to the northwest. As at the type locality, the lizards were found under granite flakes and cap-rocks. Through the courtesy of Dr. Howard K. Gloyd I have lately seen a specimen (Chi. Acad. Sci. No. 5712) collected by V. H. Householder on Superstition Mt., 5 miles N.E. of Apache Junction, Pinal County, Arizona, at an altitude of 5300 feet. This is some 90 miles southeast of the type locality.

NOTES ON *Crotalus molossus molossus*.—Until recently the only rattlesnake specimen available from San Esteban Island, Gulf of California, was USNM 64586, collected in 1911. This was a juvenile, a rather badly preserved specimen of peculiar coloration, so different from the usual mainland *molossus* that, if substantiated by additional specimens, it would have warranted at least a subspecific classification. However, there was naturally a question as to whether this procedure was justified when only a single specimen was available.

Recently, through the courtesy of Capt. G. Allan Hancock, I have secured a live adult specimen from San Esteban. This, by the shape of the rattles, and the fact that, although only 732 mm. long, it contains developing eggs, indicates that the island form is stunted. The blotches are smaller than those on the mainland specimens and are somewhat differently shaped. However, there are no differences in scutellation; and the mainland variations in *molossus* patterns are so considerable, especially between mountain and lowland forms, that this character must be considered highly plastic. On the whole, I do not think a subspecific differentiation is justified.

A specimen of *C. molossus molossus* collected by R. S. Sturgis in Carbonero Canyon (alt. 6200 ft.), Carmen Mts., Coahuila, which I have seen through the courtesy of F. M. Uhler of the Bureau of Biological Survey, is the first of the northern subspecies to be recorded from that state and tends to round out the range with the previously known Texas specimens. *C. m.*

nigrescens, the southern race, had previously been reported from southern Coahuila.

A new western record for *C. m. molossus* is based on a specimen taken by N. Bloomfield of the San Diego Society of Natural History, 1 mile east of Papago Well in the extreme southwestern corner of Pima County, Arizona. This tends to substantiate the statement of commercial collectors, still unverified by specimens, that *molossus* occurs in the Mohawk Mountains, Yuma County.

THE PRAIRIE RATTLESNAKE IN IOWA.—Somes (Proc. Iowa Acad. Sci., 18, 1911: 150) and Guthrie (Iowa Agricult. Exp. Sta. Bull. 239, 1926: 188) have included the prairie rattlesnake in their lists of Iowa reptiles based on the occurrence of rattlesnakes of some species in extreme western Iowa, and the assumption that these were closer to the range of *Crotalus v. viridis* in eastern South Dakota than to the ranges of either *Crotalus h. horridus* or *Sistrurus c. catenatus* in eastern Iowa.

Through the courtesy of Mr. W. H. Over, Director of the Museum, University of South Dakota, Vermillion, South Dakota, I have received two rattlesnakes from extreme western Iowa, and am able to verify their classification as *Crotalus v. viridis*, the prairie rattlesnake. They were collected by Mr. Over himself on the summit of the high hills extending along the east side of the Big Sioux River in Plymouth County. They were sunning themselves about badger or rodent holes. These specimens, in lepidosis and pattern, show no differences from *C. v. viridis* as it occurs in central South Dakota.

It is evident that this is not a recent infestation; the colony is no doubt a residue of a once more widespread range, now curtailed by agricultural development, the river bluffs constituting the last undisturbed refuge of the rattlers. In South Dakota, although rattlers seem absent east of Long. 98° 30′ in the farming areas, they are still to be found in the Missouri bluffs at such points as the following: Near Springfield and 2 miles from Tyndall, Bon Homme County; and Elk Point, Union County. In Nebraska rattlers have been noted in the river bluffs of Knox County (17 miles northwest of Crofton) and in Cedar County. Presumably they are of this species.

In Iowa, besides the specimens which I have seen, there are records from Westfield, Plymouth County; and Stone Park at the edge of Sioux City, Woodbury County.

Through the courtesy of Mr. B. R. Lewis, I have heard of rattlers recently killed on the Minnesota River, near Granite Falls, Yellow Medicine County, Minn. It is to be hoped that this record may later be verified. If rattlers exist in this county they are more likely to be *C. v. viridis* than either *C. h. horridus* or *S. c. catenatus*, although both of the latter occur in southeastern Minnesota.

THE RANGE OF THE YUMA KING SNAKE.—The Yuma king snake, *Lampropeltis getulus yumensis* Blanchard, 1919, has not been reported from any considerable distance north of Yuma on the Colorado River, nor has it been recorded to the westward, previous reports from Coachella, Riverside County,

California, and El Cajon Canyon, Lower California, being based on specimens of *L. g. californiae* (Herpetologica, 1:25).

On May 14, 1937, I found a specimen run over on the road, but fortunately still suitable for preservation, 4 miles west of Blythe, Riverside County, California. Blythe is in an irrigated area on the Colorado River, about 60 miles above Yuma. Also, through the courtesy of Mr. A. C. Koller, I have secured specimens from Holtville and 2½ miles west of Seeley, Imperial County. Both of these points are in the Imperial Valley irrigated area. Since this district has now been under irrigation for about 35 years, and the king snake was not previously found there, despite some intensive collecting, it is probable that it has increased its range westward by following the irrigation canals and the bordering fields. Seeley is about 70 miles west of Yuma.

The new specimens, while extending the *yumensis* range toward that of *californiae*, both to the west and north, are quite typically *yumensis* and show no *californiae* (*boylii* phase) tendencies in either color or pattern. The specimen from near Blythe has a somewhat higher number of light rings (49) than has previously been recorded for *yumensis*.

A Small Galapagos Land Iguana.—Small specimens of the Galapagos land iguana, *Conolophus subscristatus* (Gray), are not often collected, for which reason a description of a specimen lately acquired by the San Diego Zoo should warrant publication. This specimen was collected by C. S. Perkins on South Seymour Island during the Hancock Expedition of 1937–38. It has a length overall of 322 mm.

The juvenile pattern is quite conspicuous compared with that of the adults. Dorsally the head is mottled with light and dark red-brown; laterally it is gray with a slight greenish tinge. The iris is bronze. The body, dorsally, is mottled dark brown on gray, the ground color being light toward the neck and quite dark toward the base of the tail, so that the posterior marks are indistinct. The dorsal ridge and bordering areas are bronze. The dorsal mottling tends toward cross-rings, but they are not particularly even. The legs are also mottled with brown on gray. The tail is almost unicolor brown, with a narrow bronze ridge. Below the color is dull olive-brown with one light cross-band posterior to the fore legs. The essential juvenile difference is the prominent blotching and mottling, especially anteriorly, compared with the gaudy colors but virtual absence of pattern in the adults. In a second juvenile 420 mm. long the pattern has already nearly disappeared.

The Validity of *Crotalus omiltemanus* Günther, 1895.—In the *Key to Rattlesnakes*,[1] published in 1936, the probable validity of *Crotalus omiltemanus* as a valid subspecies of *Crotalus triseriatus* Wagler, 1830, was mentioned, based on its high ventral scale count. Three specimens of Günther's form are known from the type locality, Omilteme, Guerrero, Mexico, two in the British Museum, the other USNM 46343. These are the most southerly specimens of the *triseriatus* complex available, and the only ones from the state of Guerrero.

[1] Trans. S. D. Soc. Nat. Hist., 8: 185–276.

A re-examination of the USNM specimen, together with data secured with respect to the BM specimens, indicates that the subspecies should be recognized as *Crotalus triseriatus omiltemanus*, not only by reason of the ventrals, but also because of certain other differences from the typical form.

First, as regards the ventrals, we have the following data, based on 34 males and 38 females of the typical form:

	Males	Females
triseriatus triseriatus		
Minimum	135	138
Mean	148.8 ∓ 1.17	151.3 ∓ 0.97
Maximum	161	161
Standard deviation	6.80	5.97
omiltemanus	174	178, 183

No overlapping is present, these Omilteme individuals being about 10 per cent above the highest known specimens from other areas in ventral scale counts. Their deviations from the means of the typical form are about 4 times the standard deviations. There can be little doubt as to the significance of such a difference.

In addition we find in *omiltemanus* that the lower preocular is foreshortened by the encroachment of the pit, so that it fails to make contact with the loreal, while in *triseriatus triseriatus* these scales do contact, as is normal amongst the rattlers.

In one specimen of *omiltemanus* on one side, the contact of the lower preocular and loreal is doubtfully evident, but if there is contact it is within the pit, rather than on the vertical external surface.

These Guerrero specimens also differ from *triseriatus* specimens from San Luis Potosí, Guanajuato, and Jalisco, in having a greater number of small, roundish blotches; while the northern specimens ordinarily have fewer square blotches. However, any classification on blotches tends to throw the specimens from the City of Mexico basin into the *omiltemanus* classification. This, I think, is undesirable, since it leads to a less logical arrangement with respect to the ventrals, which may be considered a more stable and, therefore, more important character than pattern.

It is interesting to note that *omiltemanus* is low in scale rows and labials, as compared to the average of *triseriatus triseriatus*, which is somewhat surprising in view of the opposite trend followed by the ventrals. In related forms there is often a correlative trend in such scale counts; that is, a subspecies low in ventrals, when compared to one of its close relatives, is likely to be low in scale rows and labials as well.

In the center of the range of *triseriatus triseriatus* the blotches are low in number and square in form. Going north they show a tendency to break up into quadriads, thus eventually producing the double longitudinal rows of *triseriatus pricei*. However the number of blotches along the body in *pricei* does not average twice as many as those in *triseriatus triseriatus*, showing that some blotches are suppressed as the groups of four are formed.

To the south the blotches of *triseriatus triseriatus* grow smaller, rounder, and more numerous, with *omiltemanus* the terminal form.

To bring the key to date I would resubdivide item 37a (*op. cit.*: 248) as follows:

a. Ventrals more than 166; lower preocular short, not in contact with the loreal outside of the pit ..... *Crotalus triseriatus omiltemanus*
b. Ventrals less than 166; lower preocular contacting the loreal ..... *Crotalus triseriatus triseriatus*

San Diego Society of Natural History, San Diego, California.

A New *Rhadinaea* from Central America[1]

By Emmett Reid Dunn

FOUR specimens of a brilliantly colored *Rhadinaea* from lower Central America seem to represent an undescribed species. It may be called:

Rhadinaea ***persimilis,*** sp. nov.

Type.—M.C.Z. 19345, adult male, collected by E. R. Dunn and Chester Duryea.

Type locality.—La Loma, 1500 feet altitude, on trail from Chiriqui Lagoon to Pacific side, Atlantic slope, Prov. Bocas del Toro, Panamá.

Range.—Known from type locality in Panamá; Cartago and La Suiza near Turrialba in Costa Rica; and Eden Mine in Nicaragua.

Diagnosis.—A *Rhadinaea* with 17 scale rows; 137–143 ventrals; caudals 96–112; tail over ⅓ total length; 7–8 upper labials; two light lines on sides.

Description.—Scales 17; temporals 1–1; oculars 1–2, a tiny subpreocular on left side in the Cartago specimen and on both sides in the type; upper labials 8 in type and on left side of Cartago specimen, otherwise 7; lower labials 7 in the Eden Mine specimen, 8 in the others; the third and fourth labials entering the eye in the La Suiza specimen, and on the right side of the Cartago specimen, otherwise the fourth and fifth; four lower labials are in contact with the anterior geneials; ventrals and caudals (all males), Cartago 140 and 77+, La Suiza 143 and 112, Eden Mine 139 and 63+, and La Loma 137 and 96.

The color (taken from the freshest specimen, La Suiza) is red, immaculate on the belly, the dorsal scales edged and flecked with black. A black line runs along the edge of ventrals and row one from throat onto tail, above this a white line from throat on middle of row one to middle of tail. A white line from five scales back of second temporal on middle of row five to tip of tail. Anterior to this are: a light spot on outer anterior corner of parietals, a light spot on second temporal, a larger light spot between temporal and lateral line. There is a median light spot on fifth vertebral scale from parie-

[1] Contributions from the Department of Biology, Haverford College, No. 41.

tals. Upper labials with a black upper border, a few faint dark flecks on rostral and first few labials. The black scale edges give the effect of a black border to the light lines. Length of the largest (La Suiza) specimen 440 mm., tail 188 mm.

MATERIAL.—Eden Mine, AMNH 7412; La Suiza, given me by Dr. Carlos Viquez; Cartago, Collegio San Luis Gonzaga in Cartago; La Loma, MCZ 19345.

REMARKS.—This snake is almost identical in coloration with *Tachymenis decipiens* Günther (1895, Biol. Cent. Amer. Rept.: 163, pl. 53, f. A), and similar to *Ablabes decipiens* Günther (1893, *l.c.*: 105, pl. 37, f. A). I have examined the three types of the former and the three types and six additional Costa Rican specimens of the latter. The types of both came from Irazu, Costa Rica. Both have 17 scale rows.

Tachymenis decipiens is known from three females. They have grooved fangs; 165, 169, 173 ventrals; 85+ caudals; upper labials seven with 5th and 6th touching parietals, six with 5th touching parietals, seven with 5th and 6th touching parietals on left side, temporal in contact with postoculars on right. The head and body of the largest measured 19 inches.

Ablabes decipiens has 132–151 ventrals, 91–117 caudals, 8 upper labials, temporal in contact with postoculars, and thus agrees well with *persimilis* in scutellation. It differs in ground color, which is black, it lacks the light spots on the head, has a black and light cross collar behind the parietals, the two light lines are fainter and narrower and the upper is often obsolete. It intergrades with *Rhadinaea pachyura* (Cope) of lower Costa Rica and adjacent Panamá, and consequently should be known as *Rhadinaea pachyura decipiens*.

I am inclined to think that *Tachymenis decipiens*, despite its grooved fangs, does not belong with *Tachymenis* and probably not with *Coniophanes*. In Central America *Coniophanes* has grooved fangs and the scale rows reduce posteriorly; *Rhadinaea* has ungrooved fangs and the scale rows do not reduce. Otherwise they are similar. *T. decipiens* has grooved fangs, but the scale rows do not reduce. Furthermore it is so close to the undoubted *Rhadinaea persimilis* that some might maintain that *persimilis* specimens are merely the males of *decipiens*. I do not believe that they are, but I do believe they are congeneric. There is already a *decipiens* in *Rhadinaea*, described in 1893. Thus *Rhadinaea decipiens* (Günther) of 1895 needs a new name and I propose that it be called ***Rhadinaea güntheri***.

Costa Rica is rather a special paradise for *Rhadinaea*. Besides the three mentioned above I know of the following Costa Rican forms: *decorata decorata, calligaster, pulveriventris, serperaster, pachyura pachyura*. Of these eight, four are endemic (*güntheri, decipiens, calligaster, pulveriventris*). *R. decorata* and *R. pachyura* are lowland forms, the other six are upland, and no less than four have been taken at the same locality (Navarro: *decipiens, calligaster, serperaster, pulveriventris*). Panamá has eight forms of *Rhadinaea*, and Mexico has about the same number, but nowhere save in Costa Rica are so many forms found in the same area.

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Herpetological Notes

A NOTE ON THE LINEA MASCULINA OF FROGS.—During his stay in this country some years ago my good friend C. C. Liu, of Soochow University, discovered the remarkable secondary sex character of frogs which he named the "Linea masculina" (or Lineae masculinae). None of the authorities whom he consulted, including G. K. Noble, A. H. Wright, Clifford H. Pope, and myself, knew anything of this structure, and as there is no mention of it in such works as Gaupp's *Anatomie des Frosches* or in Holmes' *The biology of the frog*, it is not surprising that Liu published his observations as new.

His papers describing these elastic borders of the dorsal and ventral muscles of male frogs, tracing them through a great number of species, and establishing their absence in others, retain much of their value in spite of the fact that I now find that these structures had long been known, and that their function had received careful consideration. The structures in question were discovered by J. N. Czermak in 1863. He described them in some detail, referring to them as "well known" to his colleagues. No further note about them appears until 1877, when Leydig remarks on their presence in *Hyla arborea*, without further investigation, and evidently without knowledge of Czermak's papers. These structures were rediscovered sometime before 1900 by Sigmund Mayer, at whose request R. H. Kahn subsequently devoted a considerable amount of time to their study, publishing, in all, four papers on them. That the structures in question are limited to the male sex was not discerned by Czermak or Leydig, nor by Kahn in his first paper; but in 1916 Kahn showed this to be the case. Czermak named the structures the "Inscriptiones elasticae." The term "Lineae masculinae" originally suggested by my colleague, D. Dwight Davis, seems to be a better term, since it alludes to their significant limitation to the male sex. H. W. Parker, following Liu, has alluded to their conspicuous development in certain species of *Kaloula*.

Kahn interprets the structures as an elastic support for the lungs and viscera which are subject to powerful reaction from the impulses which produce the voice in the calling male. It was unknown to Kahn that the lineae masculinae are absent in so great a proportion of the Salientia, without correlation with the intensity of the voice. His suggestion is none the less the soundest yet offered as to the function of these structures, and it is supported by some acute observation of the state of the muscles in the calling male frog.

The bibliography of this topic, so far as known to the writer, is as follows:

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—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

NOTE ON THE FOOD HABITS OF *CHELYDRA SERPENTINA*.[1]—The statement of Agassiz (Contributions to the Natural History of the U.S., 1: 346) that the food of *Chelydra serpentina* "—consists entirely of aquatic animals; fishes and young ducks are their ordinary prey—" seems to convey the common idea concerning the food habits of this animal. Ditmars (1936) describes it as being strictly carnivorous, usually striking moving animals. It is known, however, that the food of this turtle may be quite varied.

This note is to record a peculiar food habit of *Chelydra* which adds to the evidence for its destructive nature. On March 4, 1938, the author, while seining minnows in a sluggish stream near Norman, Oklahoma, collected two snapping turtles. It was noted that, though *Rana sphenocephala* had been breeding in this stream for a week, there were no tadpoles and very few eggs to be found. On March 8, the turtles were dissected and their intestines were found to be full of frog eggs. Most of them were digested, while some were in good condition and still partially covered by the jelly mass. No bones or any other parts of frogs were found, showing that the eggs were not swallowed with a female frog. It is evident that the turtles were feeding on the eggs as they were deposited in the water, and that this accounts for the scarcity of frog eggs and tadpoles at that time.—J. Teague Self, *Department of Zoology, University of Oklahoma, Norman, Oklahoma.*

ON THE HABITS OF *LEIOCEPHALUS ORNATUS TRACHYCEPHALUS*.—This lizard, known locally by the vernacular name "collarejo," owing to the black halfring on the throat of the male, is one of the more common species near Bogotá (altitude 2650 m.). It is most readily observed when the sun shines, as it moves about in search of food. It eats flies, bumblebees and other insects, as well as earthworms. In captivity it is most easily fed on earthworms. A male which I kept in the garden of my home was observed catching and devouring specimens of a bumblebee, *Bombus rubicundus*, from a colony which I had in a box at the time. Quite possibly this insect is also part of the normal diet in nature, since the lizard is commonly found in places where bumblebees nest. The lizard is often infested with red mites on the sides of the neck, near the ears. The female lays two eggs only, in wet ground. The egg has a membranous cover through which water is absorbed during the development of the embryo. After about six months the young lizard is ready to hatch. Just before hatching the egg is two or three times larger than when it was laid. A peculiar habit of this lizard is that it sometimes buries itself, remaining under ground for several weeks. I do not know as yet for what purpose this is done, but it is not connected with the seasons nor with climatic changes. I owe the name of this lizard to Mr. Arthur Loveridge, of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.—Ernesto Osorno, M.D., *Bogotá, Colombia.*

MATING OF *PHRYNOSOMA CORNUTUM*.—At four o'clock in the sunny afternoon of May 6, with air temperature about 83° F., a female horned toad (*Phrynosoma cornutum*) ran across a cement walk in Georgetown, Texas, and was captured after observation. Clinging to her in copulation was a male, making no contribution whatever to their progress across the walk. His ventral surface was applied to her back, and the right hand large head spine of the female was so hidden from sight in his mouth that at first glance he seemed to be nipping the skin of the nape of her neck in the region where the spine is normally seen. This attachment was very strong and was not relinquished until several minutes later when the pair separated (perhaps of their own accord, perhaps disturbed by the minor examinations). The male's fore limbs feebly clasped the female's shoulders, his hind legs and tail dragged with no movements whatever. The penis, a very dark red structure covered by a moist mucous membrane, was exposed for fully 13 mm. between the male's cloacal orifice and where the penis curved under the left side of the female's tail to enter her cloacal orifice. The penis after removal (fully distended) measured 31 mm. long, by 6 mm. broad by 4 mm. deep, tapering only in the apical third. The attachment of the male to the female by biting the head spine seemed very peculiar. It would be interesting to know the habits of such a species as *Phrynosoma douglassii* from Oregon, in which the head spines are small.

Measurements were made of the male and female (sex checked by dissection) as follows: Body length from tip of snout to apex of cloacal orifice, male 78 mm., female 76 mm. Tail length measured from apex of cloacal orifice, male 27 mm., female 28 mm.

[1]Contributions from the Department of Zoology, University of Oklahoma, N. S. No. 193.

The tail at base was 16 mm. wide in both specimens, but at 7 mm. from the cloacal orifice was still 16 mm. wide in the male, only 9 mm. wide in the female; at 16 mm. from the cloacal orifice, the tail of each was 4 mm. wide. The long head spines of the male were 9.5 mm. in length, those of the female 7 mm. long. The male was slightly more brightly colored. Its eyes remained closed even during examination.—LORUS J. MILNE, *Randolph-Macon Woman's College, Lynchburg, Virginia.*

NOTES ON THE WINTER FROGS OF ALABAMA.—The amphibians of Alabama are an interesting aggregation of northern and southern, and upland and lowland forms. This was brought out clearly on an automobile trip made in January, 1937, in company with O.F.-R. Bruce of New Orleans. We traveled from New Orleans to La Grange, Georgia, via Mobile and Montgomery (U.S. Highways 90, 31, and 29). We returned via Montgomery, and Jackson, Mississippi (U.S. 80 and 51), with a side trip northward to Tuscaloosa, Alabama.

Parts of four nights (January 18, 19, 21, and 22) were spent in Alabama. Because of the mild winter with its frequent rains and high humidity, it was difficult to find a wet spot in hill or valley where the usual triumvirate of temporary pond frogs *Rana sphenocephala, Hyla crucifer,* and *Pseudacris nigrita* was not in chorus.

The region traversed was largely wooded. With relatively little choice of habitat, the southern leopard frog and *Pseudacris nigrita* chose more open places when these were available, while the peepers were in the more wooded places. Two additional species were recorded in the chorus, but in relatively restricted areas: *Pseudacris ornata* in the flat pitcher plant bogs of southern Alabama on January 18, and *Pseudacris brachyphona* in areas 10 and 25 miles south of Tuscaloosa on January 21 and 22. An annotated list follows.

Rana sphenocephala Cope.—Eggs were seen in the Mobile delta, opposite Mobile, on January 18, and at Moundville on January 21, and young tadpoles and hatching eggs indicated even earlier layings at Moundville. The voice was heard everywhere in suitable places.

Hyla crucifer Wied.—Mated pairs were particularly numerous at Moundville on January 21, and, without looking particularly for this species, nine pairs were taken and only one unmated male. Some of the pairs spawned in captivity during the night. As with the preceding species, the voice was heard everywhere.

Pseudacris ornata (Holbrook).—One specimen was taken near Bay Minette on January 18 to avoid any question of its identity. This frog was not heard in the Mobile delta or in the Citronelle hills east of Mobile Bay with the usual three species, but it was heard intermittently over a large section in the flat pine barrens, or pitcher plant areas, between Bay Minette and Brewton.

Pseudacris brachyphona (Cope).—The surprise of the trip was a voice heard for the first time near Moundville. The origin of the strange "qurack," suggestive of the voice of *Hyla squirella,* eluded us for about two hours before the first specimen was located; then the next six, all males, were taken in about 15 minutes. This locality, in the foothills at the extreme southwestern limits of the Appalachian Highlands, extends the range of this species some 500 miles southwestward.

Pseudacris nigrita (Le Conte).—The specimens taken at Tuskegee and Moundville are larger than New Orleans specimens, averaging 30 mm. for the six males and 32 mm. for two females (25 mm. for males at New Orleans). Their color pattern is also much more variable. In some specimens the interorbital triangle which I regard as characteristic of *feriarum* is distinct, and the stripes may be continuous or broken into spots.—PERCY VIOSCA, JR., *New Orleans, Louisiana.*

FOOD OF *MICRURUS FULVIUS FULVIUS.*—Mr. George Nelson, of the staff of the Museum of Comparative Zoology, recently captured a coral snake (M.C.Z. No. 43842) at Sebastian, St. Lucie County, Florida, which he placed in a vivarium. Returning later he found that his captive had disgorged the remains of a keeled green snake (*Opheodrys aestivus*) together with those of a second coral snake. The anterior portion of the latter was digested away, but from its gullet protruded the tails of two small snakes, apparently young racers. The captured coral snake measured 704 (622 + 82) mm., while the remains of the one it had swallowed were (440(+) + 44 mm.

A second coral snake (M.C.Z. 43484), taken by Mr. Nelson, was placed in a cage in which a young corn snake (*Elaphe guttata*) was being kept. While the corn snake

climbed to the most remote corner of the vivarium as if aware of the ophiophagous tendencies of the newcomer, it was nevertheless swallowed by the coral snake during the night.—ARTHUR LOVERIDGE, *Museum of Comparative Zoölogy, Cambridge, Massachusetts.*

DOES THE AMPHISBAENID GENUS *BIPES* OCCUR IN THE UNITED STATES?—Edwin James, in the account of Long's Expedition to the Rocky Mountains (Vol. 1, 1823: 484) writes: "We observed in repeated instances several individuals of a singular genus of reptiles (*Chirotes* Cuv.) which, in form, resemble short serpents, but are more closely allied to the lizards, by being furnished with two feet. They were so active that it was not without some difficulty that we succeeded in obtaining a specimen. Of this (as was our uniform custom, when any apparently new animal was presented) we immediately drew out a description. But as the specimen was unfortunately lost and the description formed part of the zoological notes and observations, which were carried off by our deserters, we are reduced to the necessity of merely indicating the probability of the existence of the *Chirotes lumbricoides* of naturalists, within the territory of the United States."

This record of what appears to be a lizard of the genus now known as *Bipes* from somewhere between Ogallala, Nebraska, and Julesburg, Colorado, possibly near the present Nebraska-Colorado line, has been given little credence. One wonders upon what animal such a report was based, or whether the account is fictitious. Harlan (Journ. Acad. Nat. Sci. Phila., 6, 827: 54–55) remarks—"In the Methodical Table of the North American Reptilia, we have omitted to notice a species of *Chirotes*, the existence of which in this country, is indicated in Major Long's Expedition to the Rocky Mountains, Vol. 1, p. 484."

During my collecting in southeastern Arizona during the summers of 1928–1930, and again in 1934, I have searched in vain for a species of *Bipes* which I believe inhabits southeastern Arizona. My first reason for this belief was based upon the statement of a placer-gold miner, in Ash Cañon in the Huachuca Mountains. He said that he had occasionally dug from the sand and gravel along the small creek in the cañon, "a small snake 10-14 inches long with two small legs near its head. They were purple or brown in color."

In another nearby cañon, I visited Dr. Biedermann, then nearly ninety years of age, who had lived more than thirty years in the Huachucas and had made extensive collections of Lepidoptera for the museums of the world. He told me that there was "a rare *chirotes* living in the mountains," and that he believed he had one preserved. However, on examination of his small collection of reptiles the specimen could not be found.

While collecting on Mount Lemon, in the Santa Catalina Range, I stopped at a small hotel near the summit. Mrs. Westbrook, the owner, warranted that I had found no snake like one she had found and kept for a pet. "It had a pair of legs coming out where its ears should be." It was found in the garden in the evening during a rainstorm. She had kept it for three months and it had escaped. Others vouched for the story, having seen the captive specimen.

The forest guard at the outlook station on Mount Lemon, told me that he had found in the Huachucas a specimen of a snake with "two legs on its neck. It was lavender and white below. The legs were so short that it didn't use them to walk on." Although a collector of snake skins as a hobby, he had not preserved the skin of the specimen, because it was too small.

Mr. Doty, of the Forest Service, whom I met on Mt. Lemon in 1934, told me that some months previously, his workers had killed three two-legged snakes while removing piles of rocks in order to drill post holes for telephone poles. He took me to the exact place. A day was spent in the vicinity but none was found. It was extremely dry at this time. It had been raining when they were killed.

I do not believe that all of these reports have been fabricated, and all seem to point to the same animal. It seems almost beyond question that a species of *Bipes* occurs in southeastern Arizona, at least in the Huachucas and the Santa Catalina Mountains, a real prize for some collector who will put forth the necessary effort to discover it.—EDWARD H. TAYLOR, *University of Kansas, Lawrence, Kansas.*

A GARTER SNAKE WITH A BROOD OF 73 YOUNG.—During the summer of 1937 the Pleasant Valley Bird and Wild Flower Sanctuary in Lenox, Massachusetts, began exhibiting living specimens of local snakes as a part of their educational program for visitors. One of the captive snakes, a thick-set, 37-inch garter (*Thamnophis sirtalis sirtalis*), which was believed to be a pregnant female because of her unusual size, gave birth to a brood of 73 young, thus exceeding by a large margin any previous record that I can locate. The largest brood I find recorded is 51.

The specimen was captured in mid-July on the Sanctuary grounds and has been kept in confinement ever since. Confirmation of her suspected pregnancy came in early August with the premature emission of a foetus. No further events of this nature took place until the afternoon of September 14 when living young began to appear. A rough count of some 70 little snakes on the following day was interrupted by the sudden birth of still another young one. On September 16 the entire brood was carefully counted by transferring the snakes one by one from one compartment of the cage to another. There were 68 living young and 5 additional dead ones that never emerged from the membranes encasing them at birth. An assistant checked the count. This then gives a total of 73 young, the one born prematurely in August not included.—GEORGE J. WALLACE, *Pleasant Valley Bird and Wild Flower Sanctuary, Lenox, Massachusetts.*

FURTHER NOTES ON *TROPIDOPHIS MELANURUS* SCHLEGEL IN CAPTIVITY.—In 1933, at the annual meeting of the Society of Herpetologists, the writer read a short paper on "Notes on the feeding habits of *Tropidophis melanurus* in captivity." The snakes had then been kept for one year. Since they are still alive and in excellent health and condition, a few more notes as to their habits and growth over the entire six year period of their captivity are of interest.

It may be well to review, briefly, certain facts contained in the early paper. The boas were received on June 14, 1932, having been found in a shipment of fruit from Cuba. At that time they were each about 12 inches in length and weighed (each) half an ounce. Their food was red-backed salamanders, cricket frogs, spring peepers and, when supplies failed in winter, fish, preferably haddock. Now, nearly six years after their arrival, they weigh from six to seven ounces apiece (depending on how recently they have fed); one measures about 26 inches; the other is a couple of inches shorter. Growth has also taken place, of course, in circumference. No records of their girth have been kept but they now show the typical boid shape: slender neck, body rather high in proportion to the width of the ventral scutes, short and stumpy tail. This is in contrast to their "figure" in the early days which was not then greatly divergent from that of our De Kay's snake, the length of which they approximated.

Winter feeding has been something of a difficulty since it seemed desirable to feed them, as much as possible, on their natural fare, and frogs of the right size are hard to get from dealers during the cold months. They seem to be losing their taste for fish and will take it only occasionally and reluctantly; but the winter feeding problem was solved by the availability of *Anolis carolinensis*. On several occasions baby mice of various ages and of various species have been put into the cage, but the snakes never evinced the slightest interest in them. They seem to be completely devoted to cold-blooded prey.

Shedding of the skin has been pretty regular throughout the six years. It usually takes place every three or four months, but occasionally a longer time has elapsed between moults. One of the boas once went on a hunger strike for about five months for no appreciable reason; at the end of that time it started normal feeding again but skin shedding was, of course, retarded.

During the first years of captivity the little boas showed no particular interest in water but in 1936 they took to lying in their water dish and every evening for weeks one or both would be found soaking. There was no explanation for this; no skin infestation could be observed which might drive them into the water for alleviating irritation. This habit was soon given up, and now their nocturnal activity is confined to the dry earth on the floor of their cage and the branch on which they climb. There is one rather interesting difference between their habits in captivity and those of *Constrictor constrictor*. The latter, given a branch of a tree, will loop and pack itself in the forks of the branch and there pass the daylight hours. These little Cuban boas never do that; at night they crawl along their branch or rest in its crotches, but daylight finds them

in the dark of the cardboard box placed in their cage for a retreat, or sometimes tucked in a corner behind it or behind the water dish; always on the ground; never looped on the branch.

The color of the young boas has been variously described: orange, red, terra cotta, yellow and brown are some of the shades attributed to them. In the earlier paper it was stated that, after a skin moult, there had appeared "two rows of faint, grayish spots, alternating on each side of the mid-dorsal stripe." These spots are no longer noticeable; the color pattern is simply that of longitudinal striping, occasioned by the darkening of the ground color towards the mid-dorsal line. In an effort to get an accurate color description, the snakes were compared, in March, 1938, with Ridgway's color chart. They could not be exactly "matched" but a general idea can be given of their color and pattern. With one of the snakes, the ventral scutes are Maize Yellow. The first five rows of scales are of a shade between Zinc Orange and Mikado Orange (the former is too dull; the latter too heavy to be an exact match). On the 6th, 7th and 8th rows of scales the color deepens and on rows 10-13 it is Amber Brown. A stripe down the mid-dorsal line on the 14th scale row is Chestnut. The tail is Picric Yellow. The other specimen is somewhat duller. The color immediately above the ventral scutes is Capucine Yellow; it darkens to the same shades as in the other boa, darkening stripes occurring on the same scale rows; the ventral scutes are of the same color in both snakes. The tail of the second specimen is Pale Lemon Yellow. It is interesting that the yellow tail tip has persisted so long.—ISABEL HOOPES, *Rowley, Massachusetts.*

Ichthyological Notes

OBSERVATIONS ON DOGFISH (*AMIA CALVA*) AND THEIR YOUNG.—Incidentally, during the course of other studies for the Ontario Fisheries Research Laboratory of the University of Toronto, a few observations were made on parent dogfish (*Amia calva* Linnaeus) and their young. On June 8, 1935, several hundred adult dogfish were observed on their nests in the marshes along the shore of Rondeau Park, in Rondeau Bay, Lake Erie, Ontario. Close approach to the nesting fish would send them rushing through the reeds towards deeper water. Eggs, none of which had hatched, were creamy yellow in color, and were adhering to decaying vegetation on the bottoms of the nests and to surrounding upright reed stems. Nests were about 15 x 24 inches, in water of a depth less than 12 inches and of a temperature of 25° C.

On June 13, 1935, in the blind end of a drainage cut leading into Mitchell's Bay, Lake St. Clair, Ontario, an adult dogfish was seen in company with a school of young, about one inch in length. The old fish was frightened away on the observer's close approach, and the peculiar undulating motion of the median fins changed to a vigorous sweep of the tail; this latter movement had the effect not only of sending the parent fish out of sight into deeper water, but also of throwing the swarm of young fish to the bottom and effectively screening them from sight in the newly-muddied water. The method of the adult's return to the young was distinctive. After about five minutes, it forced its way, unseen, through the bottom debris, and became visible only when it raised its head up into the vicinity of the young, the latter immediately leaving their hiding places and collecting again in a free-swimming school about the parent. This whole procedure on the part of the same family was observed three times during the hour.

When undisturbed, individual members of the school of young now and then rose rapidly to the surface and took a gulp of air. Small bubbles and a slight disturbance marked the spot. Collection of young fish was simplified by placing a ½-inch glass tube, attached to a rubber bulb, just beneath the water surface at the position where the young were rising or were expected to rise, and releasing the bulb at the proper moment.—KENNETH H. DOAN, *Franz Theodore Stone Laboratory, Ohio State University, Put-In-Bay, Ohio.*

DECAPTERUS SCOMBRINUS (VALENCIENNES) IN MONTEREY BAY.—About the first of May, 1937, Mr. J. M. Rainey, collector for the Steinhart Aquarium of the California Academy of Sciences, on a trip to Monterey Bay, observed a large school of young fish, a specimen of which he captured and placed in the aquarium. In general appearance, it was quite unfamiliar, and it made steady growth until about February 28, 1938, when it died, having reached the length of nine inches or 230 mm.

The collector, who had long puzzled over the general shape and peculiar physiognomy of the fish and wished it to be accurately identified, brought the specimen to the Department of Ichthyology, where it was at once recognized as a *Decapturus* or mackerel scad. It was somewhat abnormal in appearance, being rather snub-nosed, the result, possibly, of having grown up in the aquarium.

Upon referring to Jordan and Evermann's *Fishes of North and Middle America,* where the genus is discussed, the large number of lateral shields (45) placed it in the group containing *scombrinus,* but the presence of teeth on the tongue suggested *hypodus.* Upon turning to specific descriptions, it was found that the descriptions were of *individuals* rather than of *species,* a condition justifiable in this instance by paucity of material; for the description of *scombrinus* was simply copied from the original description, with the phrase "not seen by us," the type locality being Galapagos Islands; and of *hypodus* of Cape San Lucas they remark "five specimens known." Their description of *hypodus* was possibly also copied, with a rearrangement of the order, from Gill, but where Gill gives the number of dorsal rays as 31 they give 21, possibly a misprint or error of transcription.

Snodgrass and Heller had obtained numerous examples of *scombrinus* from the Galapagos during the Hopkins-Stanford Expedition of 1898–1899, and remarked that "there can be no doubt, however, that *hypodus* and *scombrinus* are very closely related, and it is not improbable that *hypodus* 1862 may prove to be a synonym of *scombrinus* (1846)." A specimen of *Decapterus* identified as *hypodus* was captured at Guadalupe Island, Revillegegadoes, a half-way station between Cape San Lucas and the Galapagos, during the Templeton-Crocker Expedition of 1932 (March 13).

Considerable confusion among the other species is noted by Jordan and Evermann. Of *sanctae-helenae* (Cuvier and Valenciennes) originally described from St. Helena, they say "Tropical Atlantic, 'on both coasts of South America'; not seen by us" and quote Steindachner as saying that it is identical with a Japanese species, *Decapterus munroadsi* (Temminck and Schlegel), while they say that *D. hypodus* is "perhaps a subspecies of *Decapterus macarellus,*" and that "both forms may be inseparable from *Decapterus sanctae-helenae.*"

Meanwhile Walford (Marine Game Fishes: 82) remarks "I have examined the type specimens of *Decapterus hypodus* Gill, collected at Cape San Lucas, and am unable to distinguish this fish from *Decapterus scombrinus.*"

The species of *Decapterus,* as suggested by their elongate streamlined form, appear to be wide rangers. It is probable that the young, as is true of many organisms, range more widely than the adults, and that wider extension of ranges of many species might be obtained by the capturing of young too immature to identify, and by bringing them to maturity in aquariums, as was the case in this instance.

However that may be, the capture of this species at Monterey Bay marks a noteworthy extension of its range.

Note:—Since this was written Richard S. Crocker (Calif. Fish and Game, 23 (4): 331) has reported a specimen he tentatively identifies as *Decapterus sanctae-helenae* from Catalina Island, a half-way station between Cape San Lucas, the type locality of *D. hypodus,* and Monterey Bay.—H. Walton Clark and Bruce Halstead, *California Academy of Sciences, San Francisco, California.*

NEW RECORDS OF FISHES FROM TRINIDAD.—Five specimens of *Charax gibbosus* (Linnaeus) were taken on the Island of Trinidad during my sojourn there in March, 1937. Of these, three reside in my personal collection, two in the American Museum.

One small specimen of *Lophogobius cyprinoides* Cuvier was obtained in an irrigation ditch. So far as I know, this is the first record of this species from Trinidad.—Orlando F. Weber, Jr., *22 East 82 St., New York City.*

SCALES OF LAKE ONTARIO SALMON INDICATE A LAND-LOCKED FORM.—There has long been a controversy as to whether the salmon (*Salmo salar*) which formerly occurred in Lake Ontario and spawned in many of its tributary streams resorted to salt water or were permanent fresh water residents.

The Royal Ontario Museum of Zoology, Toronto, possesses one specimen taken in the lake before 1870. It formerly belonged to the collection of the Department of Biology, University of Toronto. The Museum also possesses two other specimens secured from the Imperial Institute, London, where they were on exhibition labelled "Lake Ontario Salmon" until 1929 when they were removed from exhibition and sent to the Royal Ontario Museum. The history of these specimens is not fully known but it is believed they were sent to London for the International Fisheries Exhibition in 1883.

Examination of the scales of the specimen which formerly belonged to the Department of Biology and one of those from the Imperial Institute indicates that these specimens had never been to sea. The ages of both were the same, namely 2 years in the river and 2+ years in the lake. Both had spawned the second year in the lake. There was considerable scale absorption around the periphery of the scales, indicating that both fish had been taken in the fall of the third year in the lake and were ready to spawn the second time.

The widths of the scale ridges formed during the first summer in the lake on the Lake Ontario salmon were measured and compared with the widths of similar ridges on ouananiche salmon from Lake St. John and on sea salmon from Miramichi Bay. The average widths of 10 scale ridges from each of these localities were: .45 $\mp$ .003 mm.—ouananiche salmon from Lake St. John; .50 $\mp$ .03 mm.—salmon from Lake Ontario; and .67 $\mp$ .02 mm.—sea salmon from Miramichi Bay. The difference between the ouananiche salmon from Lake St. John and the Lake Ontario salmon is not significant but the difference between Lake Ontario salmon and the sea salmon from Miramichi Bay is significant.—A. A. Blair, *Fisheries Research Board of Canada, St. Andrews, New Brunswick.*

NOTES ON THE SCORPAENID FISH, *TAENIANOTUS TRIACANTHUS*, FROM THE HAWAIIAN ISLANDS.[1]—Among some fishes collected by Mr. Otto Degener during 1937 on Mokuleia Beach, Waialua, Oahu, T. H., were 9 specimens (U.S.N.M. 106917) of *Taenianotus triacanthus* Lacépéde and another (U.S.N.M. 106911) from a "reef" off Mokuleia, Waialua, Oahu. Mr. Degener's notes on these fish read as follows:

> Very sluggish fish hardly ever rising from substratum. Caught by wading at low tide at outer part of middle of reef where miniature grottos and cliffs of decayed corals, red coralline algae, Turbinaria, etc. occur, imitating them remarkably in color and splotching. Fish at times, particularly in aquarium, may change entirely to Sargassum yellowish-brown. Even in aquarium it will slowly oscillate from side to side as though it were a piece of seaweed swayed by ocean current. When fed with live shrimp, for example, it will, by swaying gradually maneuver into position and then suddenly swallow victim. When disturbed by other fish, it will sway toward it. Though very rare, when found it is often in pairs.

These observations on the habits of this seldom seen species also indicate the ability it has to change color rapidly. Günther (in Jour. Mus. Godeffroy, Heft VII, 1874; pl. 57) has three colored drawings of *Taenianotus*, of which A and B are like the specimens collected by Mr. Degener. There are four specimens of the light color phase, four in the blackish color phase, and two intermediates. The type (U.S.N.M. 51634) of *Taenianotus citrinellus* Gilbert (Bull. U. S. Fish Comm., 23, pt. 2, 1903 (1905): 636–657, pl. 81) is also of a light color. Counts made on these 11 specimens are as follows:

Dorsal rays always XII, 10; anal rays always III, 6; pectoral rays, one specimen on one side 13, all other 21 counts 15; pores along lateral line 21 (1 specimen), 22 (2), 23 (5), and 24 (2). Günther's figures A and B seem to have about the same number of fin rays and agree fairly well in color and other respects with our specimens.

This leads me to agree with Fowler (The Fishes of Oceania, Mem. Bernice P. Bishop Mus. 10, 1928: 296–297) in placing *T. citrinellus* Gilbert as a synonym of *T. triacanthus*. *T. garretti* as represented by Günther's figure has smooth skin, fewer dermal cirri, different color pattern, and the spines around the head are stronger and not located as in *T. triacanthus*. None of our specimens is like *T. garretti*, and the latter may be a valid species if the figure is anywhere near accurate.—Leonard P. Schultz, *United States National Museum, Washington, D.C.*

[1]Published by permission of the Secretary of the Smithsonian Institution.

Reviews and Comments

STANFORD ICHTHYOLOGICAL BULLETIN. Published by the Natural History Museum, Stanford University, California.—The inception of this new bulletin is an event of world-wide ichthyological interest. It is an outgrowth of the renewed emphasis happily being placed on this subject at Stanford University, long the prolific Alma Mater of ichthyology. In the Foreword to the first number, Dr. George S. Myers, Editor, gives due credit for Stanford's outstanding position in ichthyology to "The guiding hand of its beloved leader and first president, the late David Starr Jordan."

The bulletin is attractively printed directly from specially typewritten and arranged manuscript by the new offset method of photolithography. Dr. Myers adequately defends this method of reproduction as constituting "publication," particularly from the standpoint of the valid presentation of new systematic units. The bulletin will be widely distributed to institutions and individuals carrying on ichthyological work, and is announced as available by sale (the large first number is reasonably priced at 50 cents). Inquiries and exchanges are to be sent to the Editor of the bulletin, Stanford University, California.

The new publication will present results "of ichthyological research originating in, or connected with, the Natural History Museum of Stanford University. In content, it is expected that the bulletin will be largely taxonomic or morphological, but it is intended that papers dealing with fisheries biology shall be published." Systematic revisions, phylogenetic studies, and attempts to correlate scattered work on classification will be emphasized.

In line with this policy on publication, No. 1 of Vol. 1 of the bulletin is almost wholly devoted to Margaret Storey's commendable review of West Indian Clupeid Fishes of the Genus *Harengula* with Notes on *H. thrissina* from the Pacific Coast (pp. 3–56, figs. 1–17). The American species have long been in obvious need of critical study, and this has now been made, with full emphasis on the complicated nomenclatorial history as well as the variations and relationships of the five species (including a new species from Brazil). Large series, including material borrowed from other museums, were well utilized in defining the species with mathematical precision. Emphasis was laid on gill-raker and scute counts, but measurements were also evaluated and used, and given thorough statistical analysis. Angles between the lines of the body contours were measured instead of being almost unusably described, and were found to provide valuable characters for the discrimination of species. Skeletal features were considered, and the differential structures of scales from several specified locations were described and figured.

The second number of Vol. 1 includes two papers describing new gobies, one on American species by Isaac Ginsburg and one on a new Philippine genus by A. W. C. T. Herre. The numbers will appear irregularly, and volumes will be closed and indexed when a suitable amount of material has been published.

Ichthyologists throughout the world will wish the Stanford Ichthyological Bulletin a long and lusty career.—Carl L. Hubbs, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

SCIENTIFIC ILLUSTRATION. By John L. Ridgway. Stanford University Press, Stanford University, California, 1938: i-xiv, 1–165, 23 figs., 22 pls. $4.00.—This book is a manual of the principles underlying the effective and workmanlike illustration of scientific papers. It is intended both as an aid to authors, and as a text for use in the study of scientific illustration. The book itself is beautifully illustrated, and full of helpful and practical information on the posing of subjects, techniques of drawing, painting and lettering, on the materials of the artist, and on processes of reproduction. Several tables in the appendix give useful miscellaneous information, such as the co-ordinates of curvature, the metric system and its equivalents, geologic eras, mathematical signs, etc.—L. A. Walford, *Jordan Hall, Stanford University, California.*

GIANT FISHES, WHALES AND DOLPHINS. By J. R. Norman and F. C. Fraser. W. W. Norton and Co., New York, 1938, i–xxvii, 1–349, 97 figs. in text, 8 colored plates. $4.00.—This book was inspired by the numerous inquiries made at the British Museum for facts about whales, dolphins and the larger fishes; and it was written for people who make such inquiries—travellers, seafaring men and sportsmen, mostly; nevertheless that won't keep biologists out of it, for it is a most interesting and useful book.

Part I, by Mr. Norman, deals with the giant fishes, which are defined as those normally growing to a length of six feet or more. However, certain smaller forms that people often observe on a sea voyage, such as remoras, pilot fishes, flying fishes, etc., are also included. For the most part, the fishes are taken up in groups—as "The Sting Rays," "Conger Eels," "Tunnies." For each group described there is a résumé of such general life history lore as is known, along with brief passing comments on individual species; and there are informal pen-and-ink sketches of typical species, and very charming and suggestive color plates. A key to the principal fishes described in the text is quite easy to follow, being written in clear, non-technical language.

Part II is, so far as I know, the only compendium on marine mammals produced in recent years, and for that reason alone, the book will be welcomed by biologists. A simple key, adequate illustrations, descriptions and life history notes make it very usable indeed.

What I do not like about the book is that the authors seem to be acquainted with the animals they discuss mostly from books, and very little if at all from nature, in the living state. Furthermore, the source books used have not always been the most recent nor even the most authoritative. Also, in many cases, important material has been overlooked. Hence there are some slight inaccuracies. For example, "Dolphin has been taken on rod and line, but is not much sought after by sportsmen." "On the Atlantic Coast of America, the Tunny has never been held in much esteem as a sporting fish." "Albacores are not much valued as food." "The California species (of *Seriola*) is extensively canned."

However, these faults will probably be of slight significance to those people for whom the book is intended.—Lionel A. Walford, *Bureau of Fisheries, Stanford University, California.*

SCIENTIFIC METHOD. By F. W. Westaway. Hillman-Curl, New York, 1937: i–xix, 1–588. $3.00.—Once Science and Philosophy were inseparable and indistinguishable subjects of study. Time has changed all that, so that it is now possible for one to go through college and become a Doctor of Philosophy without even so much as reading a book on the subject. To be sure, this situation has been necessitated at once by the tremendous growth of knowledge and the limitations in the absorptive power of the human brain. Nevertheless, it is a pity that the divorce between the two branches of learning has been so complete, for though there are many sciences, the methods of them all follow a fundamental plan of sound reasoning and logic, which have their origins among the philosophers. It is not amiss, therefore, for scientists to know something about these origins and about the history of methodology. Mr. Westaway presents all this in as concise and handy a fashion as I have ever seen it done. He skims over the ground from Plato to the moderns; he talks about Words and their Elusiveness, about Opinion and Truth, and about Probability, Error and Measurement. He presents matters in a straightforward way, happily without sugar or frosting, usually, so far as practicable, in the words of the men who developed the methods discussed. The book should make a good prophylaxis against muddily reasoned "scientific" papers.—L. A. Walford, *Jordan Hall, Stanford University, California.*

BENEATH THE SURFACE, THE CYCLE OF RIVER LIFE. By H. E. Towner Coston. 163 pp., 52 pls. Charles Scribner's Sons, New York and London, 1938. $2.00.—A sincere and readable attempt to reduce the complexities of fresh-water ecology to the average fisherman's ken. Unfortunately, it suffers from a purely British trout-and-salmon outlook, and from a naïve belief that abstruse biological phenomena usually can be accounted for very simply. Our herpetological friends will be delighted to learn that progressive British frogs fertilize their eggs before laying.—George S. Myers, *Stanford University, California.*

THE WAY OF A SERPENT (A POPULAR ACCOUNT OF THE HABITS OF SNAKES). By T. H. Gillespie. McBride and Co., New York, 1938: 1–221, 18 figs. $2.50.—The author, who began keeping living snakes as a boy, retains this interest as Director of the Zoological Park in Edinburgh. The book is essentially an anecdotal account of his experiences with living snakes, and while it contains little new information, it does not pretend to be more than an elementary account. The chapter on British snakes is an interesting account of the life-histories of the three species. The section on the senses of snakes fails to include recent advances in our knowledge of this subject, and the reviewer finds the account of the treatment of snake bite, and of various minor topics, scarcely abreast of modern information. This reflects the "lag" between technical knowledge and its reorganization into popular accounts, familiar in most of the departments of science. The illustrations are new and for the most part excellent photographs by Mrs. Gillespie. An American water snake, appropriately enough in Edinburgh, may be seen engaged in eating a herring. The colored frontispiece of the green tree boa is especially attractive, though the reviewer would have preferred the characteristic pose of this snake saddled over a limb, and holding on with its prehensile tail.—Karl P. Schmidt, *Field Museum of Natural History, Chicago, Illinois.*

THE REPTILES OF OHIO. By Roger Conant. The Midland Naturalist, 20 (1), 1938: 1–200, 38 maps, 26 plates.—Here is a book that will be of interest not only to the herpetologist, but also to that increasing group of general readers who enjoy hearing about reptiles and their ways.

The introductory sections give a concise summary of previous publications on Ohio reptiles, followed by a list of the 39 species and subspecies recognized as authentic. Mr. Conant has shown a commendable critical attitude toward previous records: 12 previously reported forms are excluded as probable introductions or because of doubtful data, and 5 are mentioned as possible future additions to the state list because of their known occurrence in adjacent areas. A notable feature is the comprehensive discussion of the physiography of the state, including a map of the physiographic areas. The key is simple enough to be used by the lay reader, but adequate.

In the discussion of the species the descriptions are brief, with a minimum of technical terms, and the ranges include only those records from literature and from museum collections that have been verified by the author. For each species there is a map of Ohio, with the physiographic areas outlined, and spotted with the locality records, accompanied by a small inset map of the United States showing the general range. Under habitats and habits the author has discussed such matters as descriptions of the Ohio habitats, behavior in the field, food, and breeding habits, with an occasional reference to previously published statements, but mostly from his own field and laboratory data. These are the results of five years of intensive field work in the state; the original observations were made either by Mr. Conant or his field-companions, to whom a refreshing amount of credit is given by the author.

A glossary, bibliography, separate sections on the treatment of snake bites, on the collecting and on the preserving of reptiles, the illustrations, and an index complete the volume. The plates include line figures illustrating the diagnostic characters used in the descriptions, excellent original photographs of each animal and of a few habitats. Plate references throughout the text would have made this section more usable.

Mr. Conant deserves our gratitude for having given us such a pleasant and profitable volume, and we feel that he has earned a worthy place among that enthusiastic group of Ohio naturalists who have contributed so much to our knowledge of the fauna of their state.—Helen T. Gaige, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

EDITORIAL NOTES AND NEWS

News Items

THE construction of the ALLAN HANCOCK FOUNDATION BUILDING FOR BIOLOGICAL RESEARCH, was started in September by the University of Southern California. The new building, the gift of DR. ALLAN HANCOCK, will contain over a hundred laboratories for research in the natural sciences and steel stacks for the storage of the specimens which have been gathered on the Hancock Pacific expeditions to equatorial waters and the Galapagos Islands.

MARLIN PERKINS, formerly Curator of Reptiles at the St. Louis Zoological Gardens, has been appointed Director of the Buffalo Zoological Park. MOODY LENZ has been selected to succeed Mr. Perkins at St. Louis.

THEODORE H. EATON and DR. RANIER ZANGERL are at present studying turtle muscles and their adaptive evolution, partly to clarify muscle homologies and partly for an additional clue to the evolution of turtles.

DR. CARL L. HUBBS, of the University of Michigan Museum of Zoology, has returned from a summer spent with his family on a collecting trip in the Western United States. The field work was largely confined to the numerous isolated drainages, particularly in Nevada. A monograph on the problem of the fish faunas of the American west is contemplated.

GEORGE W. BENNETT has joined the staff of the Illinois State Natural History Laboratory, as limnologist. His chief concern will be the study of fish production in artificial lakes.

HURST SHOEMAKER, of the University of Chicago, has been appointed on the staff of the Corpus Christi Junior College, Corpus Christi, Texas, which institution is planning to devote some attention to the fish and fishery problems of the Texas coast.

The R. M. DE SCHAUENSEE ZOOLOGICAL SURVEY OF SIAM is continuing its fourth year of research and of the collection of fish, birds and mammals.

DR. GEORGE S. MYERS and DR. ROLF L. BOLIN of Stanford University, have recently returned from a two-weeks cruise in Mr. Templeton Crocker's yacht "Zaca." The object of the cruise was study of the deep-water fishes of the California coast.

DR. HUGH M. SMITH, formerly United States Commissioner of Fisheries, and Fisheries Advisor to the King of Siam, is now preparing a monograph on Siamese fresh water fishes at the United States National Museum.

ELMER HIGGINS, of the U.S. Bureau of Fisheries, has been elected to the Washington Academy of Sciences.

The BUREAU OF FISHERIES, in collaboration with the UNITED STATES ENGINEERS, is conducting a stream survey party to determine the effect on fishes of present and proposed dams on the American and Yuba rivers.

Financial aid in the publication of this issue of COPEIA has been received from L. M. KLAUBER.

Recent Deaths

DR. JOHN N. LOWE, Associate Professor of Biology at the Northern State Teachers College at Marquette, Michigan, died on July 27. Dr. Lowe was known particularly for his participation in the Michigan fish surveys and his work in fish and game management.

INDEX TO SCIENTIFIC NAMES
1938, Nos. 1-4

New names and their principal references are printed in bold face type

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